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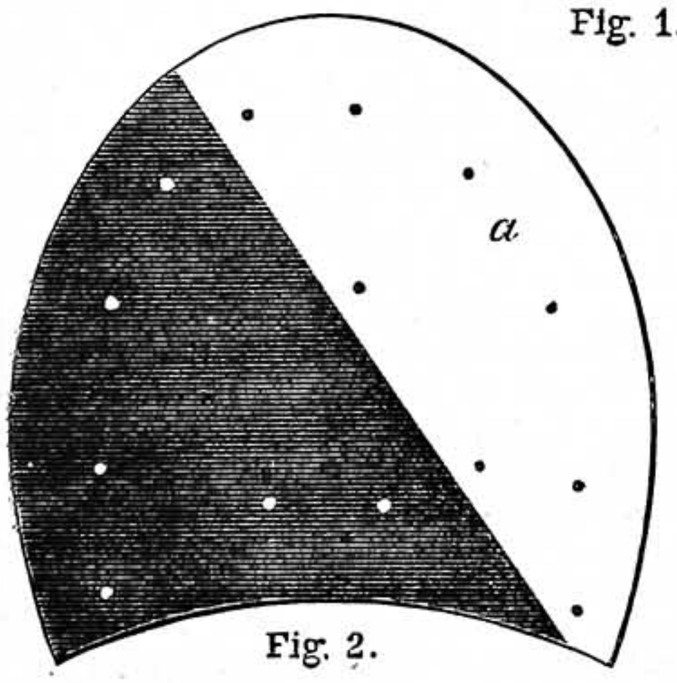
Fig. 1.



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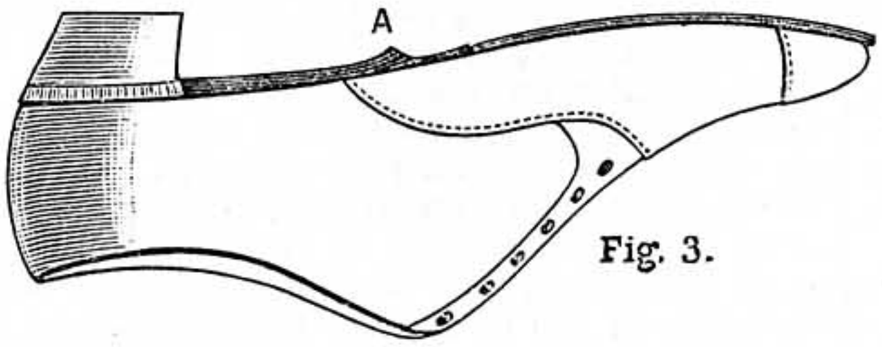

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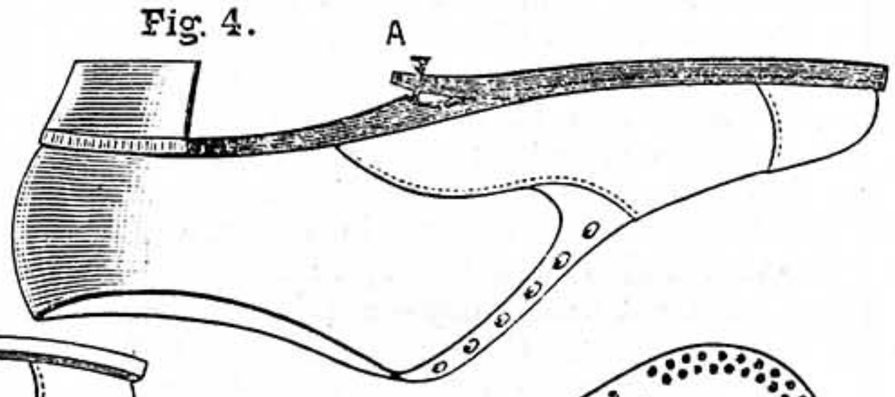

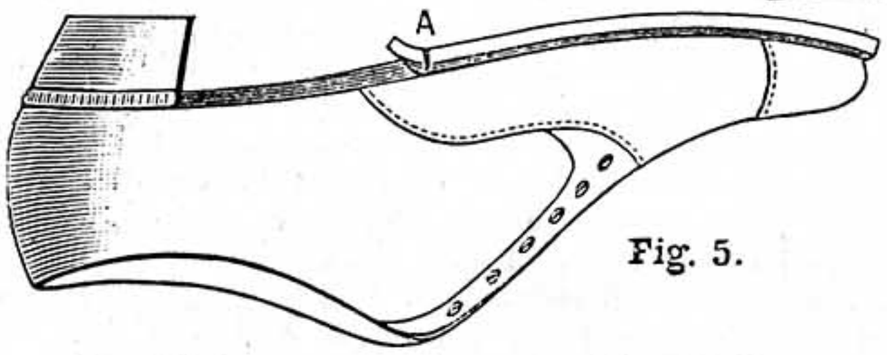

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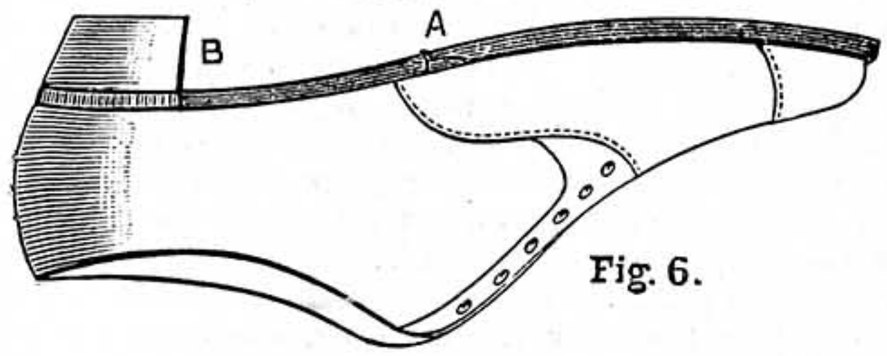

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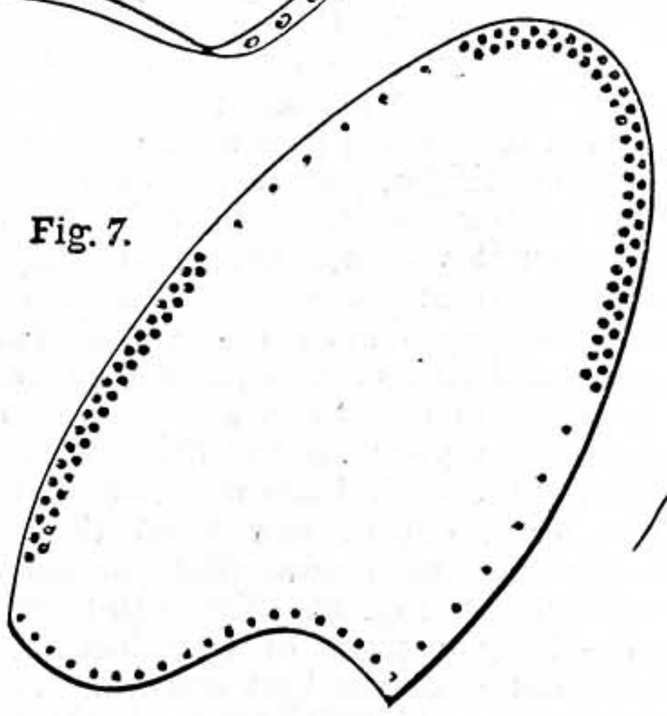
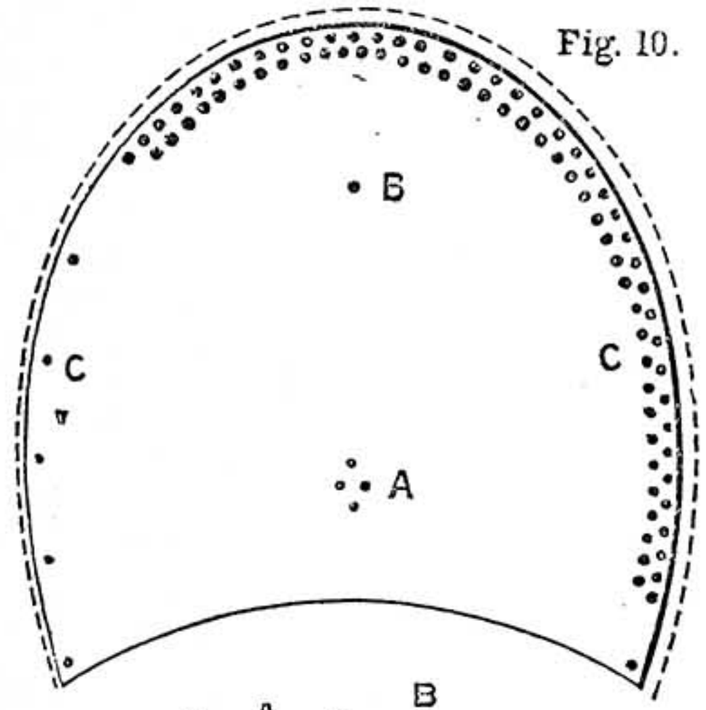
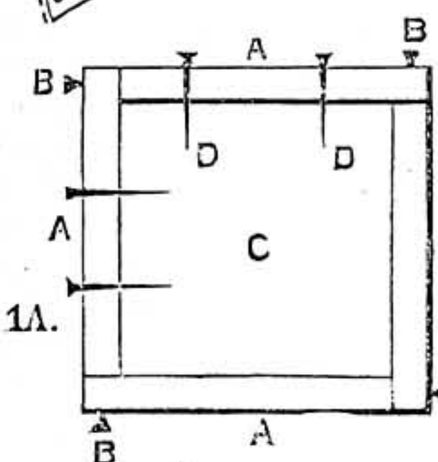


Fig. 7.

Fig. 10.





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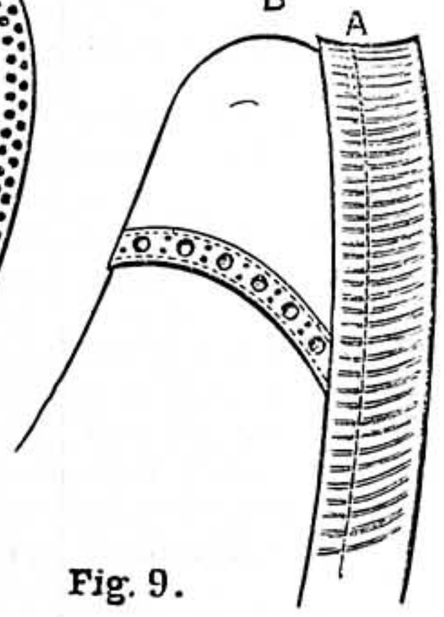


Fig. 9.

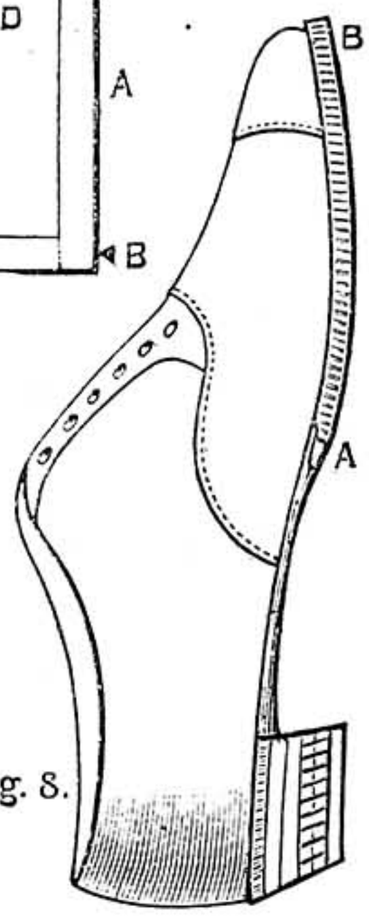


Fig. 8.

Fig. 1.—Home-Made Sharpening Strop. Fig. 1 A.—End View of Sharpening Strop, showing Construction. Fig. 2.—Lift in Heel with Worn Part (*a*) cut away. Fig. 3.—Shoe as it appears after removal of Old Sole and grooved at A for Junction of New Sole. Fig. 4.—Shoe with New Sole fitted on, overlapping Groove at A. Fig. 5.—Shoe with New Sole well fitted into Groove at A. Fig. 6.—Shoe, showing Solid Junction between Old and New Soles at A before Riveting. Fig. 7.—Mode of Pricking Sole for Insertion of Rivets. Fig. 8.—Position of Shoe for paning down Sole, as shown from A to B. Fig. 9.—Enlarged Sketch to show how Paning is done. Fig. 10.—Top Piece on Heel.

BOOT AND SHOE REPAIRING.

BY WILLIAM GREENFIELD.

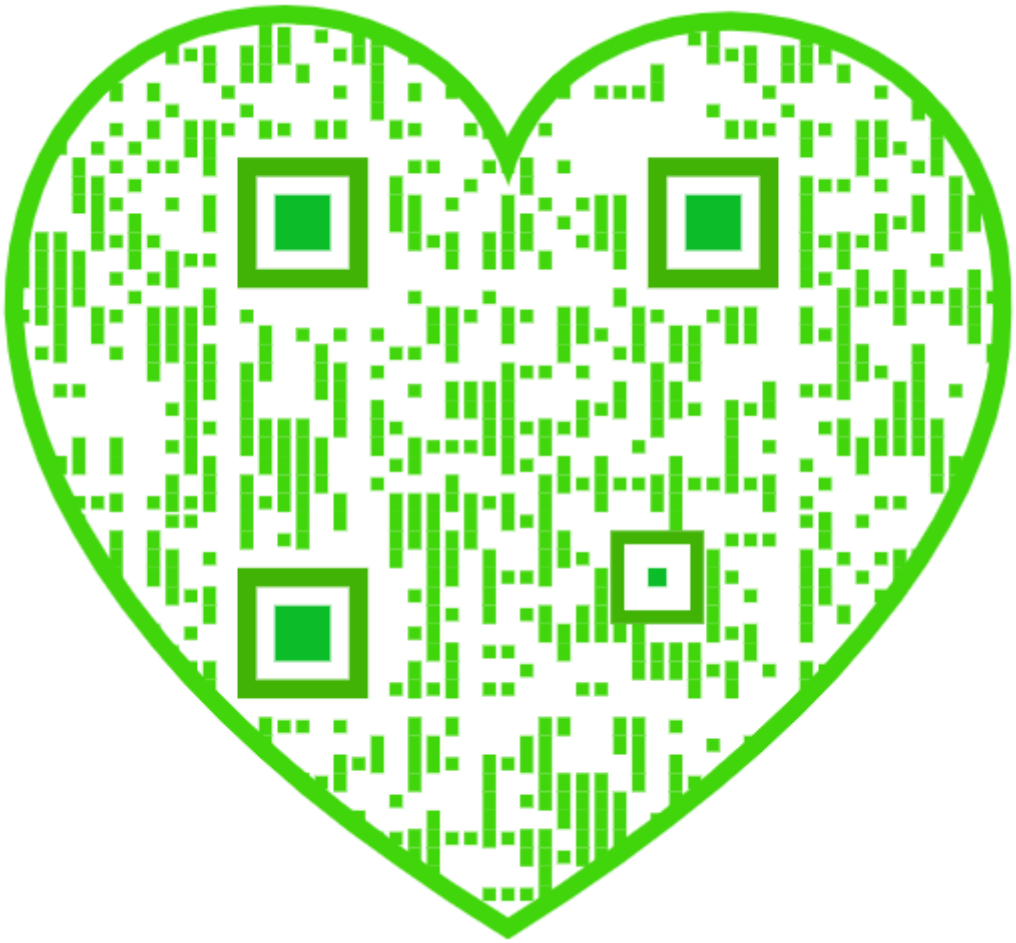
SOLING AND HEELING.

INTRODUCTION—COMPARATIVE COST OF LEATHER—GRINDERY, ETC.—THE SHARPENING STROP—TREATMENT OF LEATHER—PREPARING THE BOOTS—SOLING—HEELING—PRICE LIST OF TOOLS, ETC.

IN bringing these and the following articles under the notice of the readers of WORK, I do not think I am far wrong when I say there are a great many skilled workmen, of various trades, who read the many very interesting articles that are given us simply to gain an universal knowledge, as they do not touch their own particular trade farther than suggesting an idea or two, and therefore (although very edifying) they get but the theory, as they cannot experiment upon them, for want of spare cash as means to provide themselves with tools, materials, etc. But this can form no excuse for not putting these articles on Boot and Shoe Repairing into practice, for there are not many tools needed to start with, and leather can be bought in small quantities, and all the necessary grindery (rivets, brads, pegs, wax, hemp, paste, etc., etc.) can be bought, not only in small quantities, but at a very low rate; and last, but certainly not least, that which you are about to produce is a very great necessity, and if you do not do it yourself, you must pay to have it done; for boots and shoes are not only a luxury, but a necessity. Therefore, if a man makes this trade a study as an amateur, he at once increases his income—at least, equivalent to it; for shoe leather is like rent—to keep yourself dry and free from exposure. It is a continual outlay, and thus makes a diminution in your wages, which is often keenly felt if you have a family.

Now, this expense can be obviated by any man of ordinary ability, and he can save himself a considerable item of enforced expense.

For, in the first place, suppose your boots want soling and heeling, the cheapest you can get them done for is 2s. 6d.,



gentlemen's; and then they are done in a very inferior manner, and foreign leather nearly always used—not but what there are good tannages and parts in foreign stuff. But this class of repairer only uses what are called first-cuts (the neck end of the butt), which is the lightest leather, both in substance and weight, and consequently the cheapest. Well, a pair of soles of this kind only cost about 4d. or 5d., the top-pieces (heel-pieces) 1½d. or 2d.; so really the leather does not cost more than 7d. at the outside; so if they do not last long in wear, it is not to be wondered at. Besides, they are often put on so badly, and with such long rivets, that you cannot get the sole off again without pulling them all to pieces. But if you do them yourself, and take pains with them, you are sure to get enough wear out of them to well recompense you for the time and money you have spent upon them.

Now, if you are going to sole and heel a pair of boots, a pair of soles of English tannage will cost from 9d., and top-pieces from 3d.; iron rivets, ½ lb., 1½d. (you can buy a halfpennyworth): ½ in. is a very useful size; sand-paper, 1 sheet, size 1½, cost ½d., and ink, ½d. Then you have about 1s. 4d. left towards tools, and a better sole you would not have got, at a good many shops, had you paid 3s. 6d.

Most important in tools, and most needed, are an iron foot, a hammer, knife, nippers, glazing iron, and rasp (a price list of which I will give later on). This stipulation of tools is, of course, not sufficient to turn work out properly. But my aim is to say the least quantity possible, so that the first four or five jobs shall cost no more than if you had taken them to an ordinary repairer to have them done. Perhaps it is well to mention here that heeling, underlaying (that is, pieces under the soles), is better to start upon than soling and heeling throughout; as by this means you will gradually get the use of the tools, and your hand in for harder tasks.

Say, for instance, your boots want the heels set up on one side only, and the soles want a piece under the side, or toe-piece. This is often the case, and you can do a job like this with very few tools. But, of course, always buy a tool if you want it, and can afford it; and always try and do the work as well as you can, for it is work that, if you do take pains with, you will soon see you are making progress. As it is work that has come under every man's notice (when he has had to pay for it), he has some idea how it should look when finished.

One indispensable tool is a sharpening strop. You can buy one, which is generally a piece of square wood, solid, about 16 in. long, shaped at one end for about 4 in. to form the handle, or you can make one out of any piece of wood yourself. But while you are about it, you may as well make a good and useful one, in this way. Take four pieces of wood, ¼ in. thick, 12 in. long, and about 1¾ in. wide: place them together in a square, as A, A, A, A, Fig. 1A, and screw them together as B, B, B, B, Fig. 1A. Then cut a square piece, as C, and fix it in with two French nails at each side, as D, D, Fig. 1A. Then have a square piece, the same substance, about 6 in. long, and shape it for the handle, as A, Fig. 1, leaving about 2 in. square, to form a stopper for the square case, which you will always find very handy to keep your spare awls in, and also broken awls, the use of which I will explain later on. It is also very good to keep your sharp knife in, for if left with other tools, it gets blunt, and when you pick one tool up, you are apt to cut your hand if the knife is close to it.

When you have got it completed, as Fig. 1, paste a piece of leather on one side, and on the other three sides paste emery-cloth, sizes 1½, 1, and FF. For a fine edge to the knife use the FF, and dip the blade of the knife in water, and finish on the leather side. In sharpening a knife, always hold the blade quite flat on the sharpener, or you will get a round edge to it, and make it very hard to use.

Now, paste is very often wanted. You can get a halfpennyworth at any grindery shop. But then some of it is sure to be wasted, as it so soon gets dry. So the best way is to get a little rye-flour—a table-spoonful put into a jar, with a little *boiling* water on it, and well stirred, is economical, and you can always have paste in a few minutes.

Well, now you have leather and tools, we will start work. The chair you sit on wants to be cut down, if an ordinary chair, to about 14 in.; or anything that height will do. Your tools, for the time, can be put on the floor, or on the box you keep them in (later on I will describe the way to make a shoemaker's bench). But now we will sole and heel a pair of boots. We will suppose them to be riveted or machine-sewn, and the new soles to be riveted on; or, if hand-sewn, they must be clumped (a new sole on top of the old one), though I hope you will soon be able to sew a pair of soles on, and then they need not be clumped. Then, first of all, dip the boots into water—the soles and heels only—and hold them in for a few minutes; then let them get dry a little, so as to let them be just mellow. The leather must be put in water, and let get thoroughly wet through: take it out, and let it get nearly dry—not by the fire, if you can help it. If you do, do not put it close. Then rasp off all flesh (a rough flaky stuff on the back); then put the lap iron (a laundress's iron with the handle off) on your thighs, just above your knees, put the leather on it, grain side down, and hammer it well out even and gently, commencing from the centre. This makes the fibrous tissues more dense, and makes it more resistive of wear, and also more impervious to dampness and water in wear. But while your leather dries, take off the old top-pieces that are worn, and if the lifts are worn, cut or saw them through the centre, and take away that portion that is worn (as *a*, Fig. 2). This can then be replaced by a piece of new leather, which need not be of the best quality. There are other forms of building up heels, which I will explain as we make progress.

Now take off the old sole. This should be cut off to within about ¾ in. from where the new sole is coming down to. You can then mark it off at the exact distance or length that you are going to have the sole, and then start to skive it off from this mark in a tapered form to where you have cut it off. Then take your knife, and from the line scoop it out evenly, until you get about one-third of the way through (as A, in Fig. 3). Then tap it down lightly, right across where you have hollowed it out; this should be done with the pane end of the hammer. This hardens it to receive the pegs or rivets, and gives an extra drop to receive the new sole without weakening the old leather. Where the sole is going to be spliced to this part of the waist of the boot it must be skived, but not too thin, and this is best on the flesh side for light work, and on the grain side for heavier work. Then slightly paste the groove in the old leather, and the new sole also, where it has been skived; this tends to make the graft nice and firm when finished.

It is well to mention here, perhaps, that it is all important to properly work the leather before using—that is, wetting, fleshing, drying, and hammering, as explained above.

Then place the boot or shoe on an iron foot. The sole should be put on (the skived end) to overlap the groove about ⅛ in (as A, in Fig. 4), which, when riveted, should be well into the groove (as shown at A, Fig. 5). If the graft is well done, it will have the end of the new sole sticking up above the old leather. This must be pared off neatly with the waist, then paned and rasped off; and if these details are carried out, you will not only have a neat, but a permanently solid seam (as A, Fig. 6).

Now, before putting the rivets in, pare up the sole, but not too close—leave a small margin all round. About ⅜ in. from the edge, draw a line all round with a pair of compasses; if you have not a pair, hold a pencil between the thumb and finger, placing the second finger against the edge of the sole, which will answer the purpose. Then with an awl prick all round the sole, on the line, small holes to receive the rivets. The best way is to put them close where the most wear comes—that is, generally, at the toe and outside joint. Where it is best to use iron, and elsewhere brass, rivets, Fig. 7 shows about the form in which they should be put in.

Then, again, trim up the edge with the knife, being very careful not to cut the tops; then damp the edge, and pane it all round with the pane end of the hammer. This should be done with the shoe on the knees, with the heel towards you and the edge of the sole upwards, as shown in Fig. 8, and paned as shown at A B, same figure, commencing at A, and going right round the sole. This paning process is important, as it hardens the edge, tends to make it hollow, and prepares it to receive the next tool, which is the rasp. Fig. 9 shows the toe end of a shoe, and shows how this paning should be done to pane the new and old leather together, and keep the edge hollow (as at A, Fig. 9). Then let it dry, while you proceed with the rest. If you have had to repair the lifts (which you ought not to do, for when you repair your own boots, never let the heels go more than just through the top-piece: then you keep the heels in shape), in putting the pieces on, do not let the nails be too near the edge, or, when you put on the top-piece, one set of nails will come in contact with the other, and produce very unpleasant results. When you build the heel up, ready for the top-piece, it is well to make that side where the most wear is just a little higher—it tends to make you wear more even. Then tack your top-piece on, putting a nail at A and one at B (Fig. 10), and round it up with the knife, leaving a little on all round, more particularly the part that is to receive the most nails, as shown by the dotted line, Fig. 10. The rivets should then be put in, as C, C, but first mark it round and hole it, as you did for the soles, then pare and pane, as described above; then the edges of the soles and heels should be rasped, then buffed with a buff-knife (or scraper, as it is also called). This tool can be made with about 3 in. of old stay busk; the way to make and sharpen it is very well described in WORK, No. 24, Vol. I., pages 372 and 373, in an article on the Scraper, by A Cabinet-Maker. Such a tool can be

bought, but it is seldom ready for use, so you might as well make one right out; a piece of glass, fresh broken, will suffice. Then sand-paper the edges with a piece of 1½ sand-paper. Then the tops of the sole and heel can be filed with the file side of the rasp, to make the heads of the rivets smooth and even with the sole; then buff off the grain of the leather with the scraper, and sand-paper it all over. This is called a rough bottom, and all that is needed for own work. Now you can rub just a little paste on the edges with a piece of rag, and ink the edges and the waist (American ink is best). This you let get just dry, then iron them up with the glazing-iron. The iron must not be very hot; its proper heat can be told in this way—that is, if it is put into water, by it only being hot enough for it to just cause a frizzle. A forepart iron should be used for the soles, but the glazer will do for the trial. This ironing process gives a nice gloss, which is increased and made more permanent by ironing a second time, at the same time ironing on a thin coat of heel-ball, which can be rubbed off smooth with a piece of old cloth, which will leave a brilliant polish.

But before I leave this, our first job of soling and heeling, I must tell you I always want you to bear in mind the following: that you can finish any job in repairing much better if you have a last inside; and that paning, rasping, buffing—in fact, all finishing—should be commenced from A for the soles (Fig. 8), and from B (Fig. 6) for the heels, the only exception being in using the knife, the action of which is just the reverse in both cases; that you should get as many tools as you can, but not till you want them, and always use them for their proper purposes; and last, that I shall always try and be as explicit as possible in describing the terms, tools, and means, so as not to lead the student into any mystery that will cause him to lose his patience.

I may briefly state that an iron foot may be bought at 1½d. per lb., and a handle for 5d.; or a Paragon foot (Blakey's) may be purchased for 1s. A shoemaker's knife costs 2½d.; a hammer, 6d.; nippers, 5½d.; glazing-iron, 6d.; and a forepart iron, 8d. These may be obtained at any grindery shop; but if any reader is unable to find, or pay a visit to, any such shop, he may get the tools named, and any others commonly used in the trade, at Penton's, 1 and 3, Mortimer Street, London, W.

ARTISTIC LITHOGRAPHY.

BY MISS ADA J. ABRAHAM.

TRACERS—SCRAPERS AND ENGRAVERS—POINTERS AND GRAVERS—SNAKE-STONE—PUMICE-STONE—TRACING PAPERS—DIAPHANIE—KEY-STONE—HOW TO USE THE PEN—GELATINE—RED TRANSFER PAPER—NITRIC ACID—ETCHING—GUM FOR PREPARING ACID—ACETIC ACID—BENZOLINE.

TRACERS are best made of small round pieces of steel, about as thick as the lead of an ordinary pencil, and about 1½ in. in length, fixed in a wooden holder, and pointed just sharp enough not to scratch or tear the tracing. A hard lead pencil may be sometimes used, but the point wears thick and does not make such a clean line.

Scrapers and engravers are steel knives thick in the centre, bevelled off on either side, and made very sharp at the edges. They are of various sizes, and used for cutting lines on the stone, or making corrections, etc. A sharp penknife is sometimes useful if handled with discretion.

Pointers and gravers are round or square pieces of steel, fixed in wood like a lead pencil, and sharpened to a very fine point or a flat surface. Should the student require one finer than can be bought, he could take an ordinary tailor's needle, fix it in a wooden handle with sealing-wax, and sharpen the point to the size required. It is well to have various sizes for different kinds of work, and a hone or oil-stone should be kept for the purpose of sharpening penknives, pointers, etc. Of course everyone will know that this cannot be used without a little common oil.

A small stick of water of Ayr, or snake-stone, should be kept for the purpose of repolishing any small portion of the stone without going to the printer; this must be used with water, and the stone rinsed well afterwards with a clean sponge and water.

A piece of prepared pumice-stone will answer the same purpose as snake-stone, and has the advantage that it need not be used with water, simply scraping it clean with a knife; but it is better to use snake-stone when the water would not interfere with the drawing.

The artist must always bear in mind never to work on the stone while it is wet, or the damp surface will cause the water from the ink to spread, and so destroy its properties. Should the breath of the artist go on the stone it would have the same effect; thus he should protect the drawing by holding a sheet of paper or a protector before the mouth if he is obliged to look very closely at his work.

Various kinds of tracing papers are used in lithography; first the ordinary kind, which can be drawn on with an H or HH pencil, ordinary writing, or lithographic ink, a good clear pencil line being about the best.

French *végétal* tracing paper is much clearer than the ordinary kind, but having a shiny surface will not take the pencil readily. Lithographic pens and ordinary writing ink make very good tracings on this paper.

Then there is a specially prepared transparent paper called diaphanie, used for tracing drawings for colour work, or where more than one impression or tracing of the same sketch is required to be taken.

For instance, a drawing containing half a dozen different colours would necessitate half a dozen different stones, therefore six different tracings would be necessary; but it being impossible to make so many *exactly similar* tracings, the artist makes *one* on the above paper in lithographic ink, and then hands it over to the printer. This tracing the printer transfers to a stone called the key-stone, from which he prints as many different impressions as there are colours in the drawing—in the above instance six—and transfers them to the different stones, using red chalk in the place of ink, thus obtaining six perfectly similar red impressions from the one original.

It is difficult to know where to draw the line between the artist's and the printer's work; but it is absolutely necessary that the former should know a little of the subsequent treatment his work undergoes after it leaves his hands, and also that he should thoroughly understand and appreciate the different purposes for which any point connected with the drawing is required.

Care must be used in making the above tracing to do so on the prepared side of the paper; and this is important, insomuch that unnecessary delay may be caused by carelessness in this respect, in having the entire tracing to redraw. The prepared side is found by slightly wetting the finger and thumb, and pressing a corner of the paper between them; then whichever holds most firmly to the paper will be the right side on which to make the tracing. As a rule, the maker's name reads correctly on the wrong side, but the student will understand that this should in no instance be depended upon.

The above papers must not be confounded with the prepared papers previously alluded to, as they are only suitable for making tracings on, whereas finished drawings and writings can be made on the former.

Gelatine is also a very clear substance on which to make tracings or engravings, but more suitable for the graver than the pen. When the tracing is required to be engraved, as in the case of fine work, the lines should be cut cleanly out with a fine pointer—not too deep, but just sufficiently so to take a piece out of the gelatine, which will eventually be filled with ink and transferred to stone. It would not be of any use merely to scratch the surface, as it would not then hold the ink; and care should be taken to brush the pieces cut out cleanly away, or they will smear the lines.

When the pen is used it should be allowed to glide over the surface, and not dug into the gelatine. This applies as well to diaphanie paper, for if pressed in the surface the pen is likely to take the preparation or coating off from the paper, and will not make a clear line, which is so necessary to produce a good tracing; and whilst on this subject, the student will do well to remember that a little extra time spent over the tracing will save him double, nay treble, the labour in finding out the different parts of the drawing, especially in colour-work when it comes to be reversed on stone.

Although gelatine is so very clear, still the artist will find that for all ordinary work diaphanie paper will serve his purpose the best; and if gelatine is necessary for some fine and intricate kinds of work, it may be more worth his while to draw the tracing with the pen than to spend time practising with the graver, though of course it would be as well that he should know this, as well as every branch appertaining to lithographic drawing and engraving. It would be impossible to give details of all the different branches of lithography, which at times apply as much to the artist as the printer; therefore these subjects in future will only be mentioned so far as they are necessary for the furtherance of the lithographic student's work, in the reproduction from an original sketch or design on stone.

Red transfer paper is required for laying down the tracings already made on to the stone when it is only required to be drawn in one colour.

To make this paper, take a sheet of white tissue paper, and rub powdered red chalk upon it with the palm of the hand, putting it on with a circular motion, so as not to make holes in the paper, and also laying it on as evenly as possible. Red chalk is preferable to black, as the drawing being in the latter colour, the outline or tracing is more easily distinguished from it. Should there be too much chalk on the paper, flick the back of it with the finger and thumb; this will remove the superfluous chalk without taking more off than is necessary. One sheet of this paper will last a considerable time, and is preferable to that which is bought.

Nitric acid is necessary for etching stones, and should always be kept in a glass-stoppered bottle, and marked poison. It is much better to buy small quantities at a time, as it evaporates and loses its strength.

Etching here must not be understood to mean the same as etching on copper, steel, etc., as it has quite the opposite effect on the stone; and it is really a mistake to so call it, but as it has become a trade expression it must be let stand.

After the drawing has been made the stone is required to be etched, otherwise subjected to a wash of nitric acid, diluted with gum, which eats into the stone everywhere excepting in those parts where the drawing has protected it. No matter how fine a line or dot is made with the lithographic ink it will still preserve the stone from the effects of the acid; thus when etching on copper is spoken of it is understood that the drawing is eaten out of it, whilst in the above instance the stone is eaten away in every part excepting where the drawing has been made, which is thus raised above the level of the stone to a degree imperceptible to the eye.

To prepare the acid for etching the stone, place a small quantity of gum arabic (and please use the best) in a glass jar, and pour hot water over it, letting it dissolve; this should be made at least a day before it is required for use, and only small quantities made at a time, as it will not keep good any length of time, especially in warm weather, and nothing would be so detrimental as to use sour gum, which would eventually turn the stone mouldy and damp, thus spoiling the work.

The gum should be made just thin enough to allow it to pass through a fine strainer or a coarse piece of muslin, and should be strained into a flat dish or basin (a common earthenware pie-dish is as good as anything), after which pour some drops of nitric acid in the dish, according to the quantity required. To test if it is of the required strength, mix it well with a small brush, and try it on the edge of the stone; if it boils with a bubbling sound it is too strong, *i.e.*, there is too much acid for the quantity of gum; if it just boils—that is, if it froths on the stone—it is about right; but if it does not boil there is not enough acid in it. Another test is to taste, but not to swallow it, when it should have a sharp taste like vinegar or a strong lemon.

Acetic acid is used for preparing the stone should any alterations be necessary after the drawing has been completed and etched. Thus, if a drop of gum be on the stone, before any work could be drawn on that part, it would have to be washed off with pure water, then with a drop or two of acetic acid diluted with water, which should be allowed to remain on the stone for a few seconds, after which again wash it with a clean sponge.

Benzoline may be used to clean the stone after the drawing has been made, and before it is etched, and if used with discretion a tint may be made with safety over any portion which has been thus cleaned, provided the stone is not smeary, and that it is allowed thoroughly to dry first.

The above are the principal materials required in lithographic drawing. Any incidental ones which are not included will be duly mentioned, as they are required, in future papers on this subject; but for the present enough has been said on all things that are absolutely needed, at the commencement, by any intending lithographer, to enable him or her, as the case may be, to make a fair start.

FIXING GLASS IN FURNITURE.

BY D. DENNING.

CLASSIFICATION—FITTING PLAIN MIRROR—VARIOUS RABBETS MET WITH—PROTECTING BACK OF GLASS—BLACKING EDGES—FITTING PLAIN TRANSPARENT PLATES—FITTING BEVELLED PLATES—EXPLANATION OF "SIGHT" SIZE—TEMPLATES—FASTENING IN—PREPARING BLOCKS—TRANSPARENT BEVELS—FAULTS AND DEFECTS IN GLASS.

FOR all practical purposes the glass with which the cabinet-maker has to deal in connection with the manufacture of furniture may be classified into four different kinds: viz., plain edged, silvered and transparent and bevelled edged, silvered and transparent.

Inasmuch as they are all plates of glass, it may be supposed that they are all fitted into furniture in the same manner, and that a method which will do for one of them will do equally well for the others. In a very modified sense this may be taken as being fairly correct, but the cabinet-maker or fitter who attempted to fit all plates alike could certainly not be regarded as a master of his craft, for there are little differences which require attention. The work necessary cannot be considered difficult, and I hope by the time the reader has studied this article he will have an intelligent appreciation of what to do, and how to do it, whenever he wants to measure and fix a piece of glass in furniture. Presuming that a previous article entitled "Furniture and its Glass" has been read by those interested, we may at once proceed to take up sundry cases which are likely to occur.

Fitting a piece of plain edged silvered plate, *i.e.*, an ordinary mirror, may as well be the first supposed job to be taken up, not because it is necessarily the easiest, but for the very evident reason that we must begin somewhere. What we have first to do is to turn the framing to be glazed face downwards on a table or bench of convenient height, taking the precaution, especially if the wood has been polished, to have a piece of baize or similar material under the frame. If the back board is on, it must be removed, and it will be just as well to note whether this is laid on the back or fitted within the rabbet, but for the present we may consider we are doing with a back laid on the framing, and consequently larger than the opening for the glass. The back being off, we may as well look at the rabbet, not like owls, but like intelligent reasonable beings. If we do, we shall probably find that it is like one or other of the following diagrams, which may be taken as typical of the principal variations one is likely to meet with. The diagrams it may be well to explain represent in section the immediate parts with which we are concerned, and are shown with both glass and back fitted. The various portions will be recognised without difficulty.

In Fig. 1 we have a deep rabbet, but not a particularly wide one—in fact, it is as nice and convenient as could be wished for. All that has to be done is to measure the full size of the rabbet and get the glass accordingly. It just fills up the space comfortably, so that there can be no movement laterally or perpendicularly when the frame is in its normal position, which may be taken as upright. There is, however, nothing to prevent the plate moving backwards and forwards between the back board and the front. It is therefore necessary to fasten the plate so that it will not be movable. This can very easily be done by putting blocks or strips of wood behind the glass. They are simply glued to the framing, and provided they do not interfere with the backing board, their size and shape are unimportant. They need not be continuous, as it will be quite sufficient if they are placed a few inches apart. A convenient length for each will be two or three inches. On no account be tempted to try and fasten the plate down with brads or nails in the way shown by Fig. 2 or any other way, the risk of injuring the glass being far too great to be run with any regard to prudence. It is sometimes done. If desired, however, there can be no harm in driving a small brad or wire nail in a similar manner through the block, which it will hold in the event of the glue giving way. Care, of course, must be taken not to let the nail come in contact with the glass, for if it does the edge of this is sure to be chipped.

Fig. 3 represents a shallower rabbet than Fig. 1, being just deep enough to receive the glass without any space, or none to speak of, for the blocks.

In this case it might be supposed that it is only necessary to fasten the back down, and if the plates are but small this simple means will do very well. It will, however, be better to put a layer of soft flannel or a sheet or two of soft paper by way of padding between the glass and the back. If the glass is silvered by the old process, some such precaution is absolutely necessary to prevent the silvering being damaged. The newer process does not require such delicate handling, but it might get injured by direct contact with the backing board, especially if this is either rough or panelled. Some old-fashioned people, I believe, still advocate the use of flannel behind the glass in all cases where it would have been used in the days when the old silvering process was universal. It is simply because such people are not quite awake to some of the advantages of the new process. With this the necessity for flannel is quite the exception.

Fig. 4 shows a rabbet both wide and deep. Remembering that there is no occasion for such a wide margin of glass as there would be were the space to be filled, it is optional whether we get the glass to fit exactly or not. Certainly if to make it a close fit would necessitate our running over a measurement of a full inch, and bringing in a fractional part of one, which, it will be remembered, will be reckoned on calculating the superficial measurement as a full inch, we will just take a fair amount to go behind the rabbet. This leaves a vacant space both at the edge and behind the glass, which is free to be moved in any direction. We must therefore fasten it in by blocks which bind in both directions, as will be easily perceived from the illustration. If the space is too wide for the triangular-shaped block to wedge the glass down, the section of the block can easily be altered to that shown in Fig. 5.

In Fig. 6 we have a wide rabbet, as in the last instance, but a shallow one so that the wedge-shaped blocks cannot well be used. It is therefore necessary to use those of rectangular section, which, it is very possible, may not require any gluing in, as the glass and backing board will hold them. Now, it must be evident to anyone that if we have a back board fitted within the rabbet, as shown in Fig. 7, instead of as in former instances outside that, the available depth for the wedges is much curtailed. The methods to be adopted for fixing are, however, the same.

The following general directions should be noted. Blacken the inside of the rabbet against which the face of the glass rests, and

also blacken the edges of the glass—which, by the way, will be more or less rough. If the blacking be omitted the reflection of the wood will be unpleasantly visible, and the rough edges of the glass will reflect in an unsightly manner, unless they are an unusually long way within the rabbet. For blacking, nothing better than a mixture of size or weak glue, with some gas-black, can be used. Be careful not to let any glue get on to the back of the plate, but if any does accidentally get there, wipe it up directly. If allowed to harden, it may, in drying, very likely pull the silvering under it away from the glass, and leave an unsightly blemish.

Plain-edged transparent plates, such as are used in bookcase doors, may now engage our attention. It is clear—I mean the principle, not the glass—that wedges or blocks cannot be used, for there is no back panel with which to hide them. The glass, therefore, must fit as accurately as possible to the rabbet, where it is held by strips of beading, as shown in Fig. 8, which, after what has been said, can require no comment to render it intelligible. If, as will sometimes happen in spite of all ordinary precautions, the glass does not fit quite so tightly as it should, the only way is to put thin strips of wood in a somewhat similar fashion to that shown by Fig. 9, taking care that they are covered by this beading. This should be neatly fitted and mitred at the corners. The strips should be long enough not to require jointing except at the mitred corners. The beads may be fastened down with glue, which, however, is not a method to be altogether recommended, as in the event of a broken glass it is impossible to remove without destroying them. They may also be secured with wire nails or brads, but a much neater way is to use small brass screws with rounded heads. Instead of beads, the glass may be fastened in with putty, a method which I cannot recommend, as it seems to me to be a slovenly way of finishing off cabinet work. Those who prefer it will have no difficulty in finding out what is necessary without instructions from me.

The fixing of bevelled edged plates may now be attended to; but before doing so, it will be as well to say something about measuring for them, in order that there may be sufficient glass behind the rabbet to hold the plate securely, without too much of the bevel being hidden, for we have now not only to consider the cost of the glass, but also of the bevel—the latter of which, it will be remembered, depends on its width. Therefore, our object should be to hide as little of it behind the wood as possible—consistently, of course, with safety to the plate. Careless or thoughtless people have been known to argue that the more glass there is behind the rabbet, the more secure the plate will be, but this is not correct, as the diagrams (Figs. 10 and 11) will serve to explain. In Fig. 10 we have a bevelled plate with a very narrow margin behind the rabbet, and in Fig. 11 the same with a very much wider one. Now, on looking at these it is at once evident that the glass, being bevelled, is in contact only with the extreme edge of the rabbet, and does not lie flat against the bottom, as in the case of plain-edged plates. It is therefore unnecessary to have more than just enough glass to hold within the rabbet, and $\frac{1}{8}$ in. is generally deemed sufficient. Less may do occasionally, but cannot be recommended, and a safe rule to follow is to order the plate $\frac{3}{8}$ in. larger than "sight" size. Thus, if the "sight" size is $23\frac{5}{8}$ in. by $20\frac{1}{8}$ in., order a plate 24 in. by $20\frac{1}{2}$ in. This allows $\frac{3}{16}$ in. surplus at each edge, but then the edge is seldom perfectly regular, and this extra $\frac{1}{16}$ in. must be allowed as a waste margin for irregularities in cutting the glass.

As the term sight size may not convey much meaning to some, though it is a term well understood by those acquainted with the work under consideration, it may be advisable to explain it. Briefly, it means neither more nor less than the surface of the glass which is visible from the front when the plate is in position and fixed—that is to say, the whole of the plate, with the exception of that portion of it which is concealed by the rabbet. When a bevelled plate is ordered, it is not at all an uncommon thing to simply order it according to sight size, and leave the dealer to allow the necessary margin. It is better, in any case, to state whether the measurement named is "sight" or "plate" size, in order that there may be no mistake. If, under such circumstances, the dealer makes a mistake, the loss is his own. For irregular or fancy shaped plates, it is best to get the glass cut from a template. This can easily be made by cutting a thin board, or several of them joined together, to

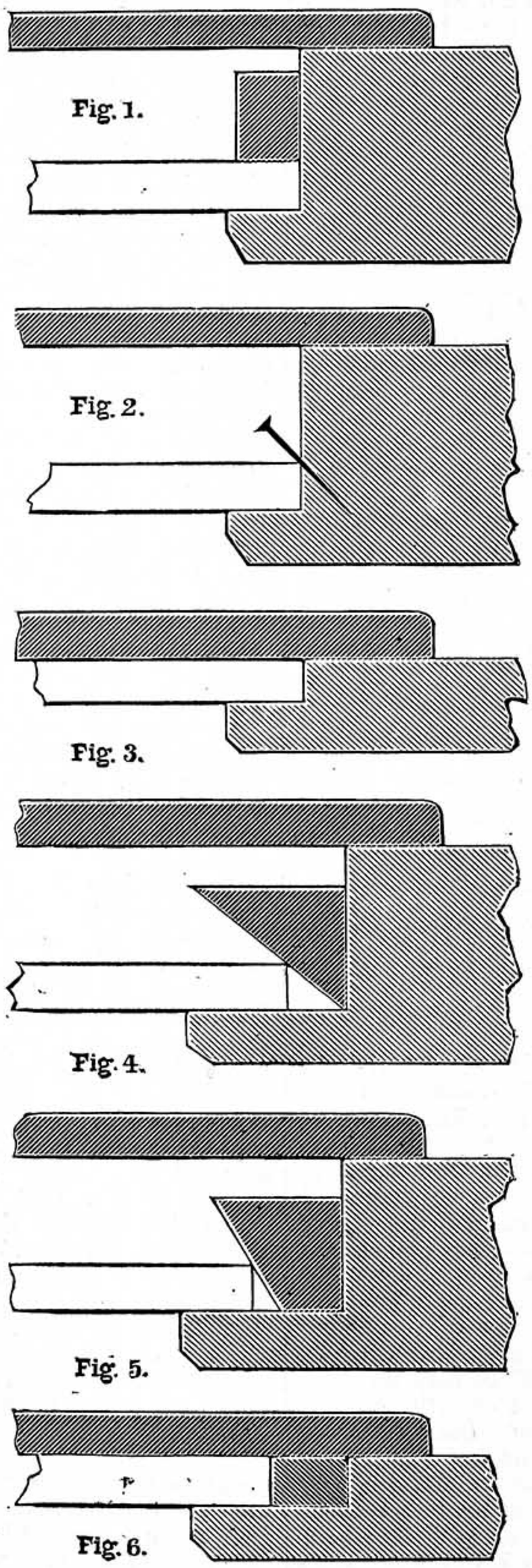


Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6.

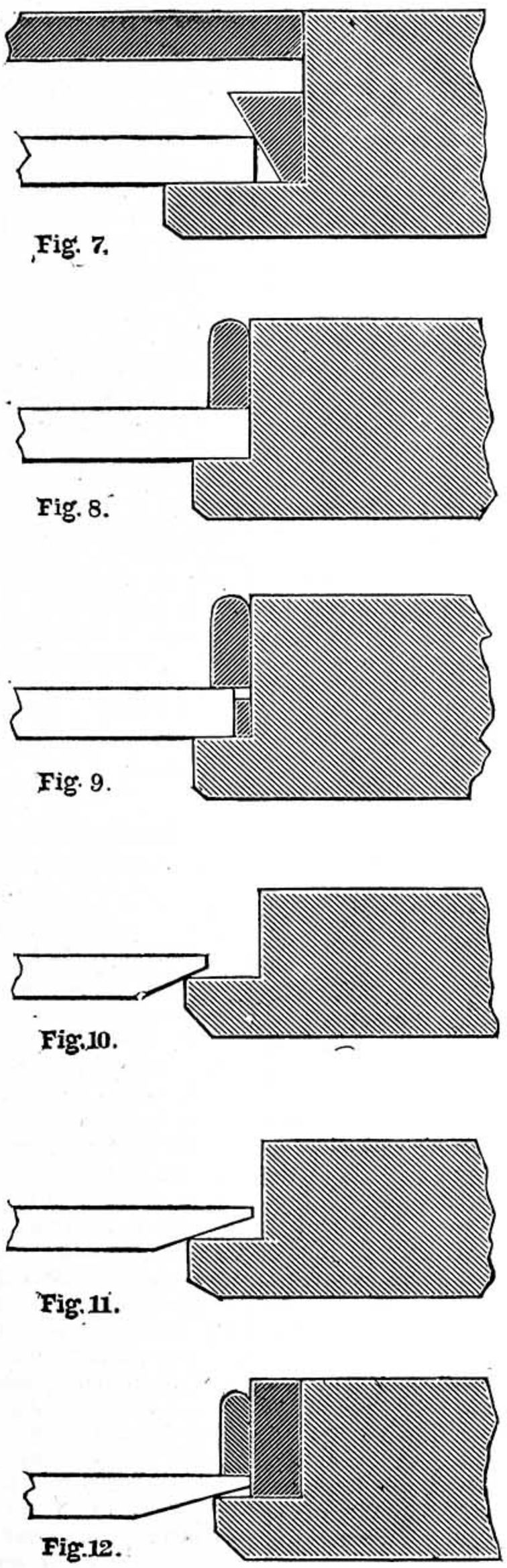


Fig. 7. Fig. 8. Fig. 9. Fig. 10. Fig. 11. Fig. 12.

Fig. 1.—Plain Silvered Glass in Deep Rebate. Fig. 2.—Ditto wrongly fastened. Fig. 3.—Shallow Rebate. Fig. 4.—Wide and Deep Rebate. Fig. 5.—Ditto with differently shaped Block. Fig. 6.—Shallow Wide Rebate. Fig. 7.—Backing Board within Rebate. Fig. 8.—Transparent Glass beaded in. Fig. 9.—Loose-fitting Transparent Glass blocked and beaded in. Fig. 10.—Bevelled Glass with little behind Rebate. Fig. 11.—Ditto with too much. Fig. 12.—Frame for Bevelled Transparent Plate with Rebate partially filled up.

fit in the rabbet, and marking the sight size with a pencil. If the backing board is made to fit within the rabbet, a simpler plan is to draw the template on a sheet of paper, which can easily be stretched on the board. Such templates will, of course, give the exact sight size, but it is best to state on them distinctly that the lines give "sight."

When it is practicable, frames to be glazed with bevelled silvered plates should, instead of being laid on a table or bench, be supported on trestles, so that the worker by looking underneath may be able to see that the glass is laid to show an equal width of bevel all round, and that the mitres fit accurately to the corners of the framing. It will easily be understood that without care faulty fitting in these respects may result. With small plates there is seldom much difficulty, but as the size increases so will the need for more care. Let me here caution all whom it may concern not to attempt to alter the position of a plate by forcing it with a chisel, screwdriver, or other tool used as a lever. It is, unfortunately, no uncommon thing in some shops to see a man trying to force a plate into position by this means. Sometimes he effects what he intends, and sometimes he damages the plate, especially if it is a large heavy one. All the movement necessary to get a plate exactly into its right position can be got by giving the edge of the framing a few light blows with the hand. The remarks which have been made about plain-edged plates are, on the whole, applicable to those with bevelled edges. When fitting these in, however, it will be found in the majority of cases that blocks, as shown in Figs. 4, 5, and 7, are the most suitable.

The best plan when working is, first, to get the plate into its proper place, then, being careful not to disturb it, fit the blocks in dry—*i.e.*, without glue. After they are placed, see that the position of the glass has not been accidentally altered. If it seems all right, proceed to glue down the blocks. It is not always necessary to blacken the edges and inside of the rabbet in the case of bevelled plates as in plain ones; still, no harm can result from doing so.

The blocks which are needed do not require to be of very high finish, and seldom are so. It is no use wasting time over them. I have known large quantities of them prepared in the following manner. A board of 1 in. pine of straight even grain is taken. A piece about two inches wide is sawn from one end across the grain. From this the blocks are shaped by splitting it up into square pieces first, and each of these diagonally afterwards with a knife or chisel. They may not look very elegant, but they serve their purpose; so what more can be required?

Bevelled transparent plates are fixed in a similar manner to those with plain edges, but the rabbet should be only a narrow one. This can easily be arranged when making the frame, if it is then known that the plate is to be bevelled. If the rabbet is too wide it will generally be better to reduce it to the proper dimensions by gluing continuous strips of wood, as suggested by Fig. 12, than to waste money by having a wider bevel.

It will occasionally happen when a plate to exactly fill an opening is got, that the glass, through some irregularity at the edge, will not quite enter. In such a case a little judicious paring away of the obstructing wood with a chisel will often do all that is necessary, and is much more satisfactory than trying to chip the glass itself to make it fit.

Some discretion is often advisable in selecting which shall be the top or bottom of a piece of glass when it is fixed. For instance, we have, let us say, an oblong piece, one end of which will be high up, where it cannot be closely inspected, while the other will be where every defect is conspicuous. Naturally, it will be better to fix the glass so that its worst end, if there is any difference, will be at the top. I am not wrong when I say that cabinet-makers have been known simply to reverse the position of a plate supposed to be defective—perhaps actually so—instead of replacing it by a new one. The defect has been put where it is not so easily seen: that is all; the results have been perfectly satisfactory. The chief blemishes found on silvered plates are scratches on the metal or glass, water stains caused during the silvering, and small round bubbles or seeds in the glass itself. To all intents and purposes, it is impossible to get an absolutely perfect piece of glass of any size; though it may be sufficiently good for all purposes it will not stand the very minute inspection which some bestow on it. The scratches which are visible on a really excellent piece of bevelled silvered plate when it is held in broad daylight to reflect light direct from the sky are something to alarm the novice. In conclusion, I have only to say to purchasers of glass that before finding fault with any sold to them, it will be as well to take the opinion of someone who knows the material as to its quality, and that I trust the novice will find the foregoing hints sufficient to enable him to do whatever he may want in fitting glass to furniture.

ELECTRO-SILVERING SMALL GOODS.

BY GEORGE EDWINSON BONNEY.

PREPARING THE SMALL GOODS—CLEANING—SCOURING—STRIPPING AND QUICKING THE GOODS—MAKING THE SILVER-PLATING SOLUTION—WORKING THE PLATING SOLUTION—FINISHING, POLISHING, AND BURNISHING SILVER-PLATED GOODS.

Preparing the Small Goods.—By small goods I mean the various little oddments which come to the counter of the country jeweller to be replated, such as alberts, charms, lockets, brooches, buckles, scarf-pins, rings, and one or two spoons or sugar-tongs. I should not advise undertaking the job of plating spoons and forks in dozens, nor anything larger than a dessert spoon, as larger articles demand more room than can be found in the small vat of a working jeweller, and more anode surface than he has at his command. More care must be taken in the preparation of articles to be silver-plated than in the preparation of those to be electro-gilded. The hot solution of cyanide of gold will dissolve remaining traces of animal matter, but the cold solution of cyanide of silver has no such detergent effect on dirt left on the surfaces of goods intended to be silver-plated. We must, therefore, be sure to free the surface from the least trace of dirt of all kinds, whether in the form of rust, verdigris, tarnish, and any other form of corrosion, or in the form of oil, grease, lacquer, sweat, and other animal matter. The touch of a soiled finger on the prepared surface is sufficient to spoil it, and cause the silver to strip off from that spot when the scratch-brush or the burnisher is applied to it. All deep scratches, dents, cracks, and pits must be removed before the goods are re-plated; all necessary repairs must be done (and in doing these, avoid an excess of soft solder); all the previous coats of silver or of nickel must be removed, and the surface must be polished.

If the articles are free from corrosion, but appear to be dirty from grease or oil, place them for a time in a boiling hot solution of caustic soda or caustic potash, then rinse them in hot water. It is always advisable to make this the first course of treatment, whatever may be their condition. If they appear to be lacquered, steep them for an hour or so in warm methylated spirit, then transfer them to a strong solution of ammonia, to loosen the lacquer. After such treatment, they should be well brushed with an old scratch-brush or bristle-brush, and rinsed in hot water. Use old brushes for this purpose, as it will not be advisable to use the same brushes for brushing the surfaces of finished goods. Tarnish may be removed by soaking for a short time in a strong solution of cyanide of potassium, to which has been added a few drops of liquid ammonia. Green verdigris and similar forms of corrosion may be removed by dipping in a mixture of equal parts sulphuric acid and water, to which is added half part nitric acid and a few drops of hydrochloric acid. The articles should be strung on a wire, and swilled in the dipping mixture for a few minutes, until the corrosion has been loosened, then rinsed in plenty of clean water. After this, they may be brushed with an old scratch-brush, and again swilled in water. If the verdigris is not all off, they must be again swilled in the acid pickle until quite clean.

Scratches on the backs of watch-cases and lockets, and pits left from corrosion in other articles, must be taken out with a fine file, then the file marks rubbed out by grinding with water of Ayr stone, after which the surface should be scoured with a cork dipped in powdered pumice, then polished bright in the usual way. Spoons and forks should receive similar treatment. It is not necessary to be so particular in getting a very finely polished surface for silver-plating as for electro-gilding, since the coat of silver can be got up afterwards; but the same care will be needed to get an uniform surface, free from scratches and pits.

Stripping the Silver Coating.—All the old coat of silver, nickel, or gold must be stripped off before we can successfully deposit a new coat on the article. It sometimes happens that the plater fails to get an adherent coat in his first attempt. If part of it strips off under the scratch-brush or the burnisher, the whole remaining part of the coat must also be stripped off by the following means: Get a vessel capable of heating and holding acid at boiling point, such as a porcelain evaporating dish or a stoneware pipkin. Pour into it enough strong sulphuric acid to cover the article about to be desilvered, and make the acid hot over a gas stove or oil stove on a sand bath. When the acid is hot, sling the article in a piece of copper wire, immerse it in the hot acid, and add a few crystals of saltpetre. These will dissolve, and give out just enough nitric acid to dissolve some of the silver. Move the articles about in acid, and add more saltpetre, until all the silver has been dissolved off. If proper care is taken, all the silver may be stripped off without pitting the underlying surface of brass or of German silver. When quite free from silver, the surface must be rinsed in water, scratch-brushed, and prepared to receive a fresh coat of silver. If the article has been nickel-plated, it must be swilled in either the before-mentioned stripping acid or in a warm mixture of two parts sulphuric acid

and one part nitric acid, taking care, in both processes, not to keep the article in the acid longer than necessary to strip off all the nickel. It is most important to have the article dry before putting it in the stripping acid, to prevent irregular action. Gold may be stripped off in a warm mixture of nitric acid three parts, and water two parts, to which must be added, as required, a few crystals of common salt or a few drops of hydrochloric acid.

Articles made of pewter, lead, tin, Britannia metal, solder, or any other lead or tin alloy, may be entirely cleaned in the caustic solution, without the use of acid. Rust on iron or steel may be removed by soaking in dilute sulphuric acid, to which has been added a few drops of hydrochloric acid. Both this metal and alloys of tin and lead must be first coated with copper in an alkaline coppering bath (described in the last chapter) before they are placed in the plating vat to receive a coat of silver. In the case of iron and steel, this must be done promptly after cleaning, before a film of rust can form on their surfaces. Lead and tin, and other alloys, must be plated immediately after they are taken from the potash solution, without rinsing in water. Articles made of brass, German silver, and similar white or yellow alloys, receive a more adherent coat of silver when first coated with mercury in a solution of proto-nitrate of mercury in distilled water. To make this, dissolve a few drops of mercury slowly in a mixture of equal parts nitric acid and distilled water, using only enough acid to dissolve all the mercury, then dilute the whole to twenty times its bulk with distilled water. Swill the articles in this when they are ready for the plating bath, then rinse them in clean water. This is named "quicking" the articles.

Making the Silver-Plating Solution.—The solution for silver-plating is easily made. Get some pure re-crystallised nitrate of silver, in the proportion of four and a half ounces to each gallon of solution required. Also get ¼ lb. of 95 per cent. pure cyanide of potassium for each gallon of solution. To make one gallon of solution, dissolve the silver nitrate in half a gallon of distilled water in the glass vessel intended to serve as a vat, and half of the cyanide of potassium in one quart of distilled water. Add small portions of the cyanide solution to the nitrate of silver solution, and stir well with a clean stick between each addition of cyanide, until all the silver has been thrown down in the form of white curds, and a few drops of the cyanide solution fails to cause a white cloud in the silver nitrate liquid. When this condition has been achieved, pour off the useless liquid (which contains nitrate of potash), and pour a quantity of clean common water on the white precipitate. Allow this to stand for a few minutes, then pour it away, and repeat this some two or three times, finally draining off all the wash water from the silver cyanide precipitate. Dissolve the remaining cyanide of potassium in distilled water, and stir this into the wet precipitate of cyanide of silver until all has been dissolved. Then add one-fifth more cyanide, and make up the solution to one gallon with distilled water. This solution will be worked cold. For an anode, use a plate of absolutely pure silver having a surface area slightly larger than that of the largest article, or total area of the largest group of articles, likely to be plated in the vat. It is best to have an excessive surface of anode, as we can always draw out this to suit small surfaces being plated. If the anode does not dissolve cleanly and freely in the solution whilst at work, add some more cyanide in small quantities at a time.

Working the Plating Solution. — Each article must be hung to a long hook made of copper wire, and suspended by this in the solution whilst receiving its coat of silver. For very small articles this hook may be made of No. 28, whilst for larger articles it may be made of No. 20. This hook is made in the form of an S, the lower end hooking behind a pin, into a bow, into a link, or to some projecting part of the trinket. The articles should be wired with wet hands before the final dips, and not touched with the hands afterwards, but placed straight away in the plating solution, suspended to the cathode rod attached to the zinc of the battery. Two or three cells in series will be enough to force current through the wires and deposit the silver in good condition. The articles should be coated white with silver within a few minutes of placing them in the depositing vat. They should then be taken out and brushed with a clean scratch-brush in clean water, to test the adherence of the deposit. If this does not strip, the article must be rinsed in clean water, and restored to the vat to receive a finish coat. The time taken to do this will depend upon the price to be paid for plating, since a longer time in the vat represents a thicker coat of silver. By carefully weighing the article after it is polished, preparatory to plating, and weighing again when dried, after it has been plated, we can find out the weight of silver deposited upon it. A thick coat of good adherent silver may be deposited in two hours; but the time taken will always depend upon the condition of battery and solution, so I cannot lay down a fixed rule. I may say that for 6d. a trinket we can only afford a mere blush of silver over and above the scratch-brush coat, and this may be laid on in a few minutes.

Finishing Electro-Plated Goods.—When the articles are sufficiently coated with silver, disconnect the slinging wires from the cathode rod, swill the plated goods for a few seconds in the bath, then rinse them in hot water, and rub or bury them in hot boxwood sawdust until dry. Plain patterns may be rubbed dry with soft linen rags after being rinsed in hot water. When dry, brush out all sawdust from crevices with a soft brush, and proceed with the polishing processes. If only a thin film of silver has been deposited, as for whitening buttons, etc., rattle the articles about in sawdust, and brush them with a mop of soft rag charged with plate powder. If a thicker coat of silver has been deposited, and the deposit has a "matt" appearance—*i.e.*, creamy white, without lustre—it must be scratch-brushed until the "matt" surface gives place to one having a dull lustre. This must be done with a clean medium scratch-brush made of medium brass wire, using stale beer as a lubricant. If doing this by hand, rest the articles on a sloping strip of smooth wood in a tub or similar vessel, and use the brush in strokes away from the workman, to avoid splashing the beer over the clothes. Rinse each article in clean water, and dry again as before, either in hot boxwood sawdust or by rubbing with soft linen rags. By using a fine scratch-brush to finish off after brushing with the coarser brush, a tolerably good surface may be given to the plated goods, and this, when polished with a plate-brush, will suit customers better than the higher polish imparted by revolving mops and burnishers. The work of polishing can, however, be more expeditiously performed on a revolving mop or dolly in a polishing lathe than by hand with brushes. A very fine polish can be imparted to silver surfaces with rouge applied on a revolving calico mop, finishing off with a softer mop of swans'-down, and finally polishing with the palm of the hand.

Burnishing.—The highest polish is given by the process of burnishing — that is, rubbing the surface with burnishers made of polished steel or polished bloodstone. The burnishers are kept lubricated with freshly-made soapsuds, and the strokes of the burnisher are all given in one direction. When only small portions of a trinket have to be burnished, just to stand in relief to the rest of the surface, the burnisher may be a highly polished steel bodkin. It should be polished on a piece of buff leather charged with rouge. An illustrated article on "Burnishers and Burnishing" may be found in page 411, Vol. II. of WORK.

MEANS, MODES, AND METHODS.

To Stain Mahogany Port-Wine Colour.

Procure a little quicklime, and stir it up in water, making a kind of weak limewash. Apply this to the surface of the wood until you get the required tint; allow it to dry, glass-paper off, and polish in the usual manner.—F. C.

Gold Paint, for Touching up Frames.

Mix together gold bronze and copper bronze to the desired shade; if required a rich deep colour, more copper; if lighter, more gold. Mix with Japan gold-size thinned with turpentine, just as much as is required for immediate use.—H. H.

Fastening Corners of Gilt Frames.

These are nearly always nailed together, but if a really good job is desired, in which no nail-holes are to be seen or the gilt interfered with in any way, proceed as follows:—After shooting the mitres true and clean, bore from the inside of the mitre with a small quill-bit out to the back side, not out to the edge. Then sink with a gouge to admit a fine 1¼ in. or 1½ in. screw; put screw in position to mark where hole comes in the other mitre, bore with a sprig-bit, glue slightly, and screw down. If this is done clean and well, we have a firm joint, and nothing seen on either edge—a great desideratum in gilt frames.—H. H.

WIRE-WORK IN ALL ITS BRANCHES.

BY JAMES SCOTT.

Crimping Machines—Benches—Tools.

Two machines for crimping or corrugating wires of various gauges are shown in Figs. 5 and 5A respectively. That represented in Fig. 5 is used for small gauges of wire. I am not very well acquainted with the technical terms used in the iron trade; therefore, should I, during my descriptions of these machines, not use the accepted trade definitions, my readers must forgive me for my ignorance, although this want of knowledge on my part will not prevent me from giving proper explanations.

In Fig. 5 there is a thick standard, divided into two separate parts horizontally, as indicated by the cross line, and held together by a pair of screws, which penetrate sufficiently deep into the lower half of the

standard to afford the requisite strength, and whose heads are above the standards, as shown. On the front are two barrels, which receive the axles of the wheels. The latter are removable from the axles, and are held to them in such a manner as to prevent them rubbing against the standard, or slipping from the barrels, by washers, etc. Through the ends of each axle, opposite the wheels, is a removable pin to prevent the wheel and axle from being pulled out of its place accidentally.

In working, the wheels are brought sufficiently close to each other to receive the particular gauge of wire to be crimped by the perpendicular screws being turned. For various degrees of crimping, different pairs of wheels of the same diameter as each other are used, the cogs on each pair varying in thickness to those on the remainder, in order to secure long or short crimps, as the case may be. It is to allow all wheels to be properly fitted that the axles are made detachable from the barrels by removing the pin in the end of each.

The machine shown in Fig. 5A affords the same facilities as those gained from that in Fig. 5, the difference being that these wheels are used for stouter gauges of wire and larger crimps. Here the axles are supported by side standards at each end, in which fit square blocks (see view Fig. 6A) to receive the axle ends. The square blocks slide up and down the standards, and consequently carry with them the axles, wheels, etc., in order that a change of wheels can be made when required for purposes previously named. At the top of each standard is a cap, both caps being united by means of a cross-bar. Each cap is hinged at the back to a standard, and in front is removable, being held firmly, when desired, by means of a loose nut attached to a fixed screw, which latter penetrates through a hole in the cap.

For closing the wheels together there is an attachment at each side, shown separately in Fig. 6B. On the outside of top axle-block is a stout barrel, through which passes a movable screw-rod. In a similar manner, there is outside each lower block a barrel, into which is firmly imbedded a horizontal screw, which enters the screw-rod just alluded to. It should now be seen how the wheels can be brought to the requisite adjacency to each other by means of turning the side screw-rods over the side screws. I will now pass on to remarks on the benches and tools.

Simple benches only are used by wire-workers. There is, therefore, not the slightest necessity for me to give drawings of such. They are used in a great variety of sizes, according to the shape of the shop wherein they may be fixed.

Of the tools proper only a few are necessary. These are large shears (Fig. 6), hand shears (Fig. 7), nippers (Fig. 8), pliers (Fig. 9), vices, and hammers. There are several adjuncts, which, however, I prefer to term accessories, and shall describe in future papers, where I can deal more appropriately with them. The first of these tools is used for cutting up bundles of wires into required lengths, and for this purpose the shaft (C, Fig. 6) is fixed in a large vice and firmly secured, the cutting being done by working the handle pump-wise. The hand shears are used for similar operations when the wires to be cut are not so thick or strong as to require the aid of the large shears. The assistance of the pliers is called in for "turning over," and the nippers for "squeezing down" and clipping off superfluous ends of

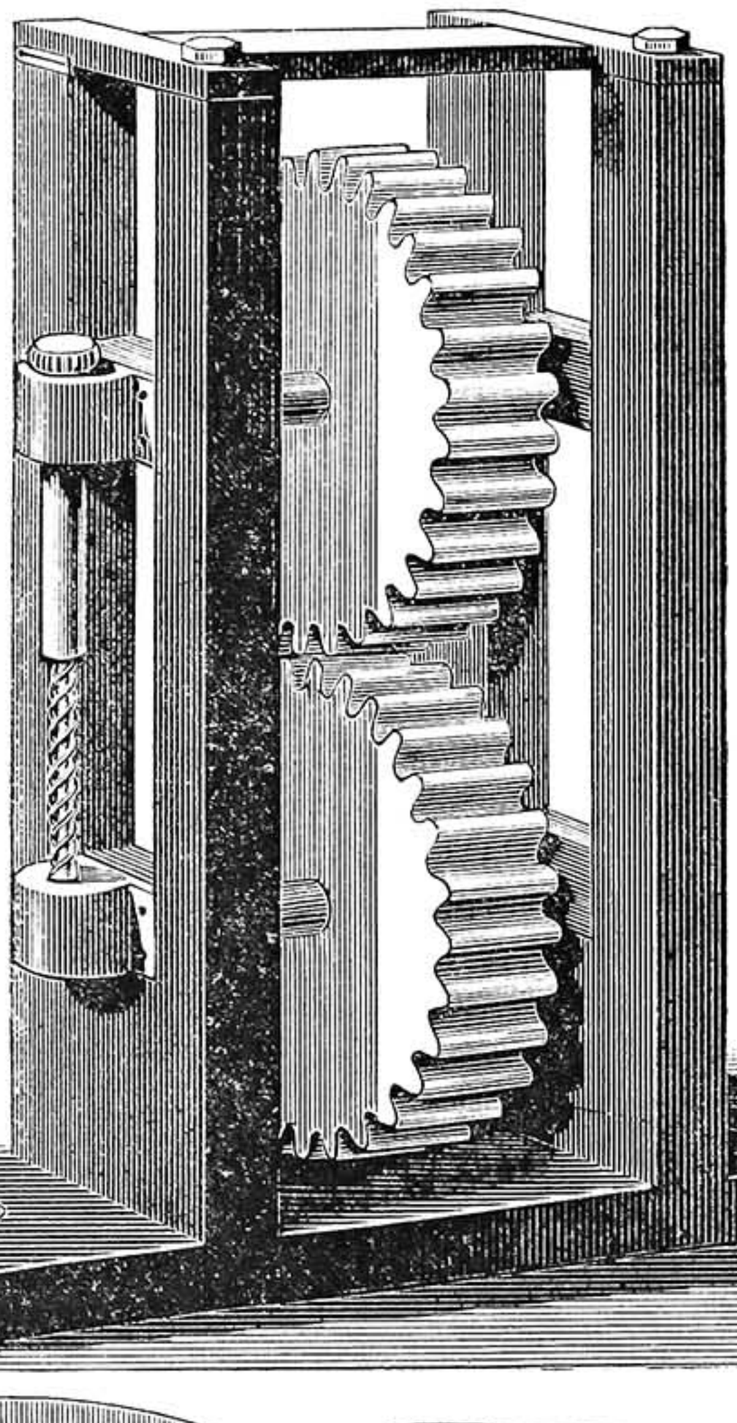


Fig. 5A. — Another Form of Crimping Machine.

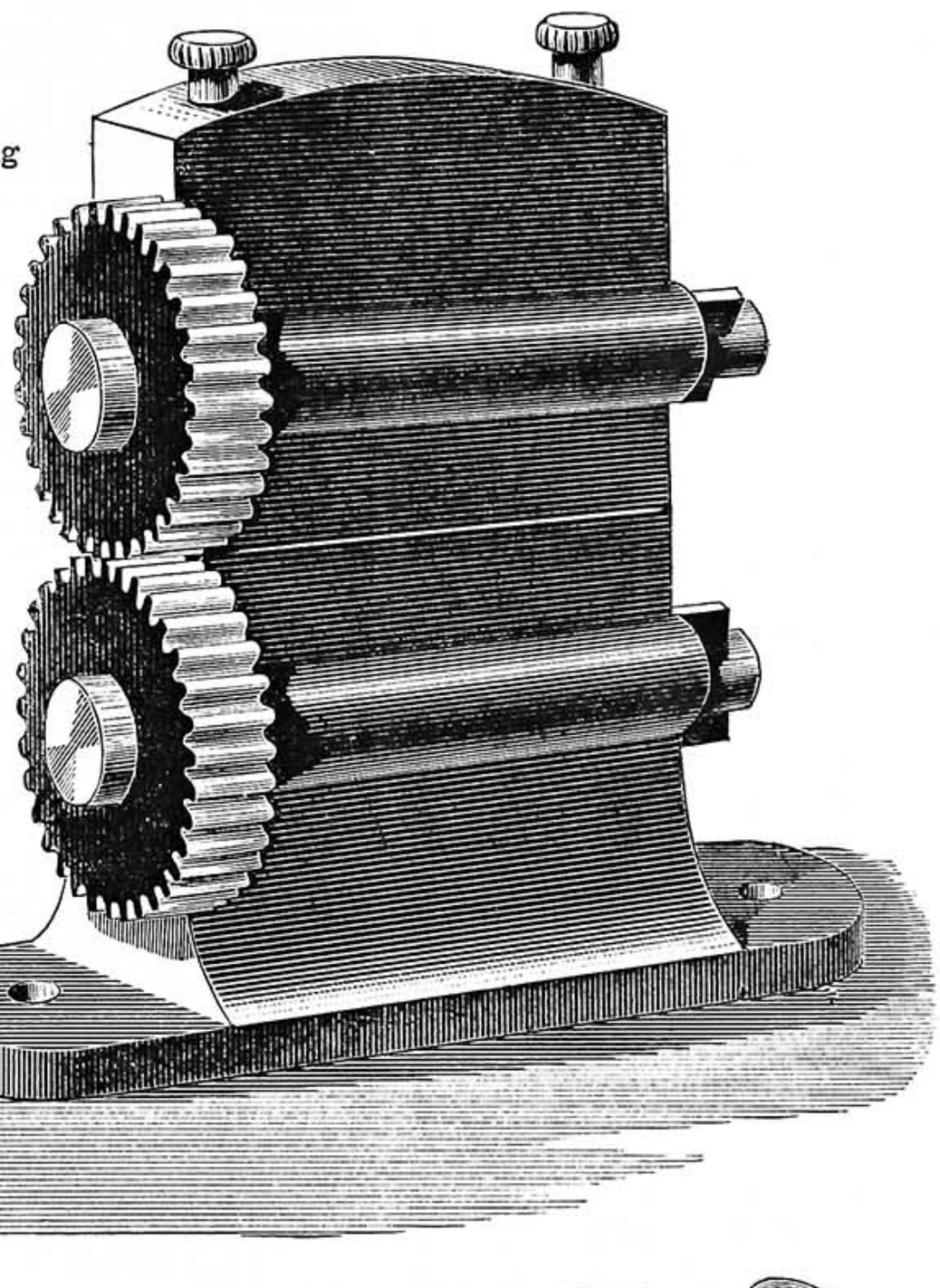


Fig. 5.—Crimping Machine.

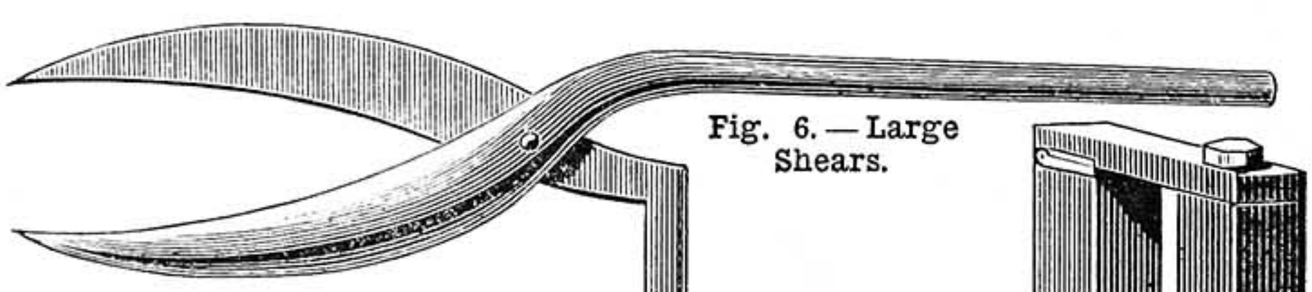


Fig. 6. — Large Shears.

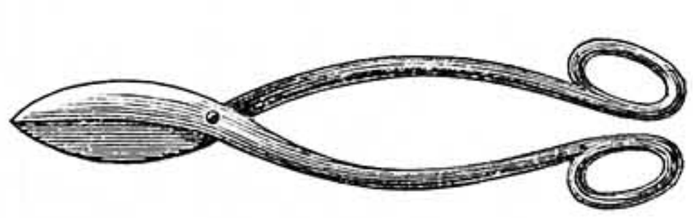


Fig. 7.—Small Shears.

Fig. 6B. — Adjusting Screw of Fig. 5A.

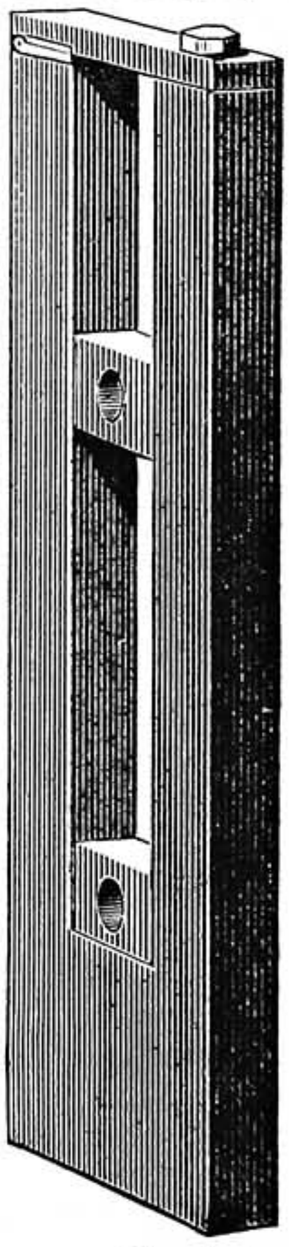


Fig. 6A.—Side Standard of Crimping Machine shown in Fig. 5A.

Fig. 8.—Nippers.

Fig. 9.—Pliers.

wires. Hammers and vices need no commenting upon. The different processes previously named in connection with these tools will be described by me later on.

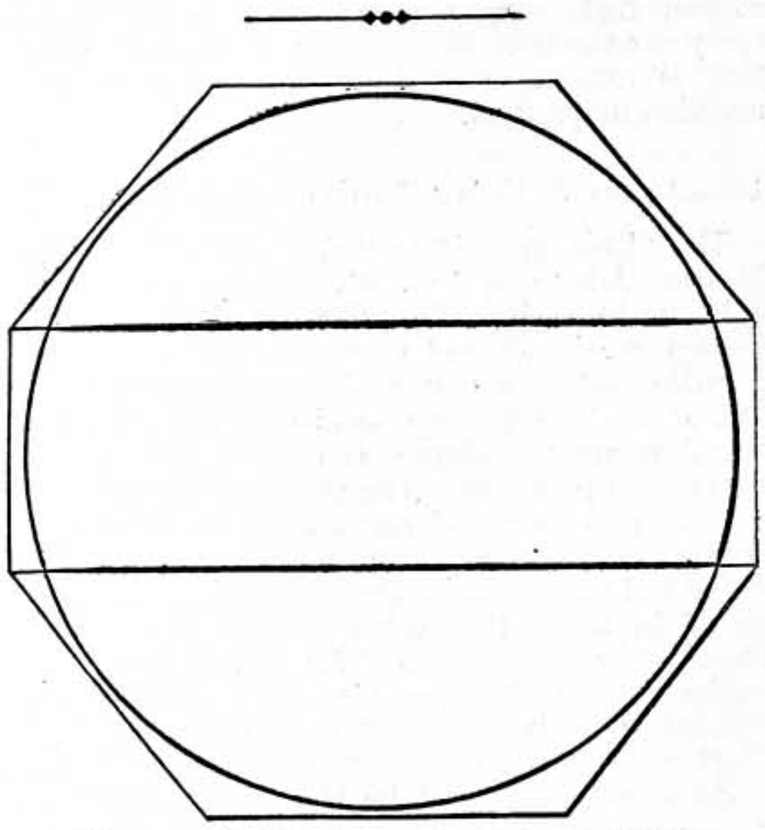


Fig. 1.—Jointing up and cutting out Top.

HOW TO MAKE A ROUND TABLE.

BY H. HINGE.

METHOD OF CUTTING OUT TOPS—SETTING OUT—SADDLE FOR MORTISING LEGS—SHAPING RAILS—FRAMING UP—SECURING TOP, ETC.

A THREE-LEGGED round table appears at first sight a simple job, but if a man has never seen one made, or been instructed in the art of making one, he will find a difficulty in doing so unless he goes the right way to work and begins properly.

Where round tables are manufactured for sale, workmen generally get them to make by the dozen, and it is astonishing how quickly they can be made. The method generally adopted is as follows :—To begin with, the tops are jointed up ; these consist of three pieces of stuff, 9 or 11 in. wide (unless a special size is wanted), of dry, sound pine or deal ; if 9 in. wide, the middle piece is cut off, 2 ft. 3 in. long ; if 11 in. wide, 2 ft. 9 in. long, by laying another piece of stuff alongside the middle piece, and marking a circle with a trammel,

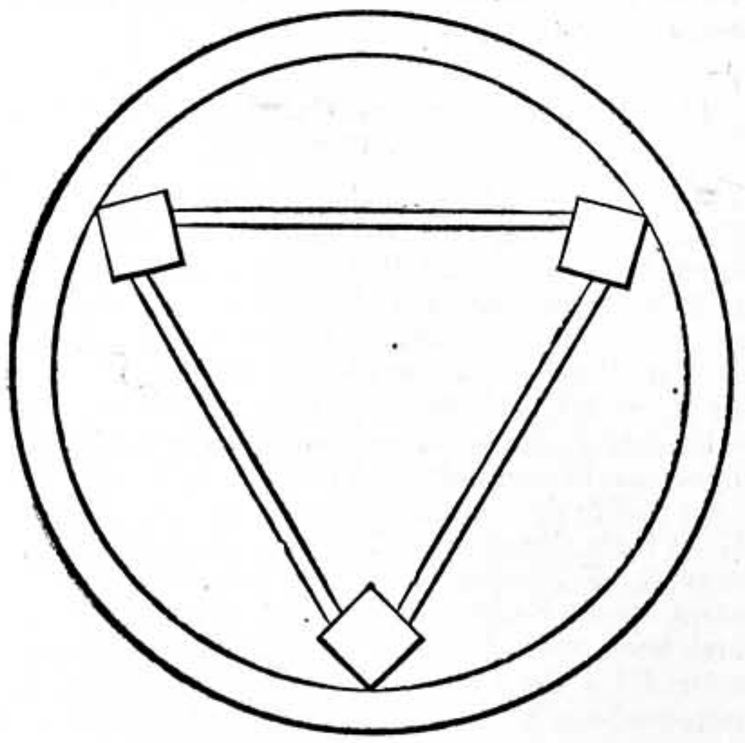


Fig. 2.—Setting out Position of Legs and Frame.

or some other means. It will be seen, by cutting the next length off on the bevel, and reversing the edge for the other piece, that a considerable quantity of wood can be saved in cutting out a lot of tops. Fig. 1 will explain the method of cutting out tops. The tops are seldom more than slip-jointed (shooting the edges straight with a plane, and gluing and rubbing). Of course, if a better class of thing is wanted, it can be grooved and tongued together, or dowelled. Now, to set out for the frame, we want a board as large as the top—the top will do very well if the joints are dry. Prepare it by planing it up on one side, and mark out the circle you want the top to finish, and then mark another circle $1\frac{1}{4}$ in. less, which will indicate the outside size of the frame. Divide this into three parts to form a triangle, and mark the size of the legs, keeping the square of the leg on the spot, as shown in Fig. 2. When all three squares are marked, it is only necessary to fill in the rails, letting them stand in from the outside of the legs as much as is necessary to give strength and room for the tenon. The frame is now "set out," from which we can get the lengths required for the rails, and the right bevel to mortise the legs. A bevel should now be set by laying the stock of the bevel along the line which indicates a rail, and the blade set to the angle of the leg. A piece of 3 in. scantling is now planed up square, say a foot long, and pre-

Fig. 6.—Round Table when finished.

pared by marking it with the bevel, and from the bevel a line taken up square (to receive the leg for mortising), the piece is cut out true to the lines, and we have what is called a saddle. Fig. 3 shows the saddle with a leg in ready for mortising. The legs are set out 2 ft. 4 in. or 2 ft. 5 in. high, and the breadth of the rail marked on it, allowing an inch from the extreme height of the leg for what is termed a hancheon, so that when the leg is sawed off level with the top of the rail the mortise will still be down an inch to give strength. When the leg is secured in the saddle, which is generally held firm by the bench holdfast, the chisel is held quite upright, and the mortises cut in the ordinary way. The rails are generally made of $\frac{3}{4}$ in. stuff, about $4\frac{1}{2}$ in. or 5 in. wide. The length we can get by measuring on our setting-out board, allowing it long enough for the tenons. When these are planed up and taken to a breadth, one of them is marked on the bottom edge for shaping, which generally takes the form of Fig. 4. All three are held together in the bench screw, and cut out with a bow-saw, and trimmed up with spokeshave or rasp, and all done that is necessary while in that position. If a quantity is being made, a templet, or pattern of thin wood, would be made to mark from. Care must be taken not to have the tenons too tight, or else they will split the legs, but yet fill nicely the flat way, and in the width be tight, as there is no danger of splitting that way. In setting out the rails, a shoulder is only made on one

Fig. 4.—Rail properly shaped and tenoned.

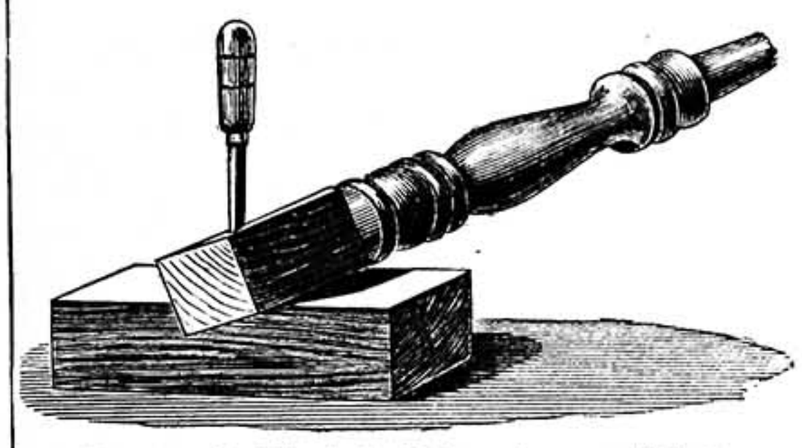


Fig. 3.—Saddle to hold Leg for mortising.

side (the inside), and, instead of being square, it is bevelled about a quarter of an inch, which will cause the legs to stand out when the table is framed up. The rails should be smoothed up and all done we consider necessary before the table is glued together ; it may be found necessary to use a cramp to get the joints up. All being on the bevel, it must be watched where it is pulling, or else it will do mischief. Blocks of wood should be fitted in the corners and glued in, which will greatly strengthen the frame. When the glue is set, the tops of the legs should be bevelled off with the frame and planed true. Sometimes pins, or dowels, are bored in the legs to keep the joints up, but a cabinet-maker would scorn the idea of ever putting dowels in to hold a tenon up. A rail about 3 in. wide and 1 in. thick should now be fitted across the frame to hold the top true. Fig. 5 shows the top of the frame with rail in. The rail is let down the thickness of itself to come level with the rails, and nailed down firmly. Holes are bored in this rail to receive some stout $1\frac{1}{4}$ in. screws to screw the top down.

The top is prepared by cutting round

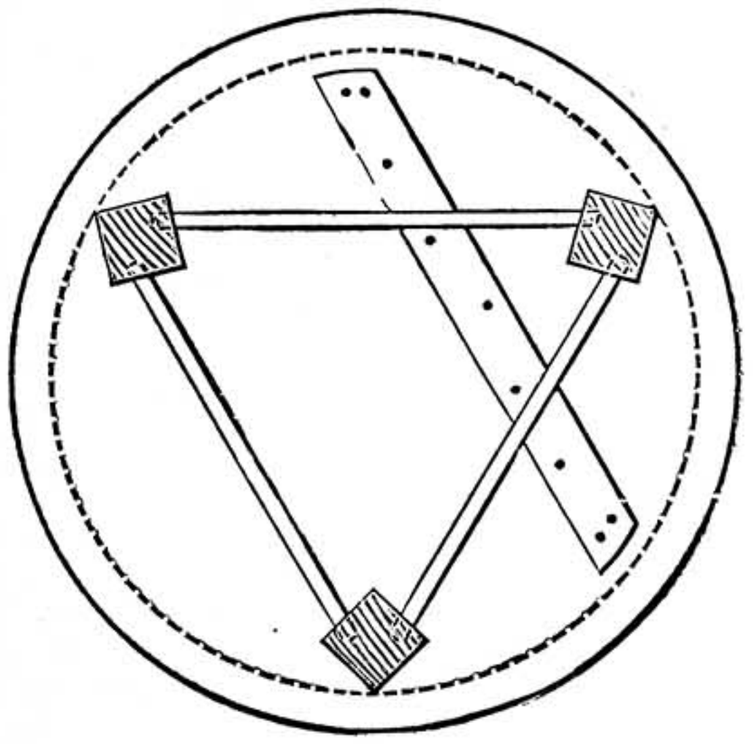


Fig. 5.—Underside of Top with Cross Rail in.

with a bow-saw, and cleaning up the edge with either spokeshave or sharp smoothing-plane, placing the best side down on the bench. The frame is placed on it in such a position that the flat rail comes across the joints of the top. It is now screwed firmly

down, and, placing it on its legs on the floor, the top is nailed to the other rails from the top side, and a good 2½ in. or 3 in. nail sent down into each leg. These are punched down with a punch well below the surface, to admit of the top being smoothed up with a sharp smoothing-plane, the sharp edges of top being taken off with a piece of coarse sand-paper. The top is sand-papered across the grain (a little white putty having previously been put in the nail-holes) till smooth and clean, and our round table is complete.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

13.—PITMAN'S NEW "DEMON" WATER MOTOR.

MR. P. PITMAN, Aubrey Road, Withington, near Manchester, has sent me a prospectus of his New "Demon" Water Motor, and a specimen of the smallest or No. 1 size for testing. The motor itself appears to be well made, and there is no fault whatever to find with it in this respect. The following are particulars of its dimensions, taken from Mr. Pitman's prospectus, in which all of these are stated to be approximate only:—Bore of pipe, ¼ in.; diameter of pulley, 2½ in.; weight, 24 lbs.; height, 9 in.; breadth, 8 in.; revolutions per minute at 60 lbs. pressure, 1,800; power, quarter man. Price, 25s.; regulator extra, 3s. The general description is as follows:—"Inside the motor is a drum, on the circumference of which are several cams. The water entering by the supply pipe forces these cams to rotate, until each cam in turn comes opposite the exhaust pipe, when the waste water falls through the exhaust exit of its own weight. The mechanism is not subjected to severe shock; there is a steady and continuous outward impulse, and such changes in velocity as do occur balance each other exactly. The shaft and all wearing surfaces are of hardened steel, gun metal, and brass, and are fitted with oil cups and lock nuts. The pulley wheel may be removed and another of more suitable size put on in its place, or an additional wheel may be keyed on the opposite side, if found desirable. The working parts are boxed in a removable cover, being fitted to facilitate examination, etc., of the machinery." It is further claimed that "it is the cheapest and best motive power engine (both in first cost and when working) that has yet appeared;" and that "this engine is a most useful and economical motor for driving every description of small machinery; and is now thoroughly established as a success in the hands of practical users." Its appearance and construction are fairly shown in Fig. 1, which, it should be said, is from a photograph of No. 2 motor complete.

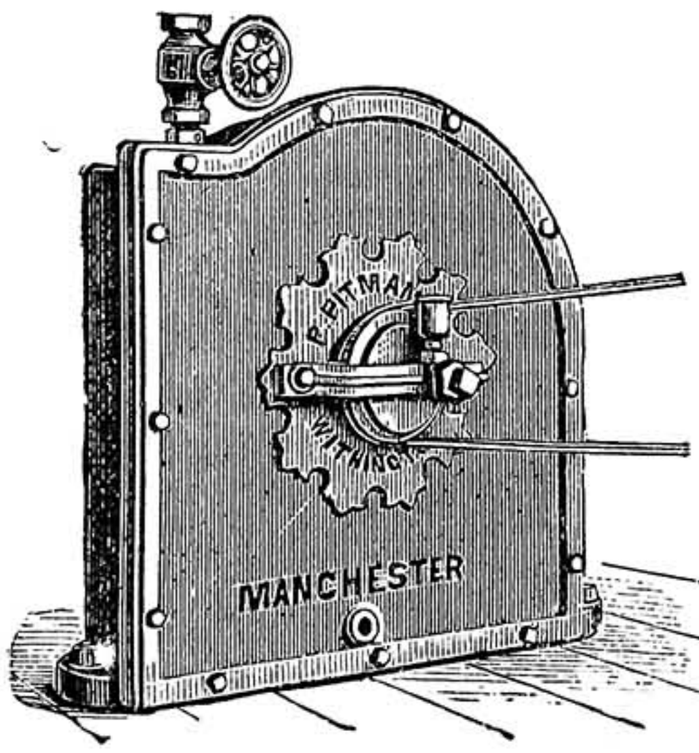


Fig. 1.—Pitman's New "Demon" Water Motor.

On receipt of the sample motor, I put it into the hands of a practical man for thorough testing, and the following is his report:—"In reading through the instructions for fitting in Mr. Pitman's circular, I notice that he says:—'When feasible, I recommend, as the most economical method of driving, that the power be conveyed direct from the motor by belt or rope, *without* the intervention of countershafts or separate gearing.' I understand this to mean to save power, not expense. I therefore connected motor to water supply, and ran a small gut direct to pulley of lathe head. The power and speed given off were so small that when I placed a piece of wood to the ¼ in. drill which was in the lathe, the motor immediately stopped.

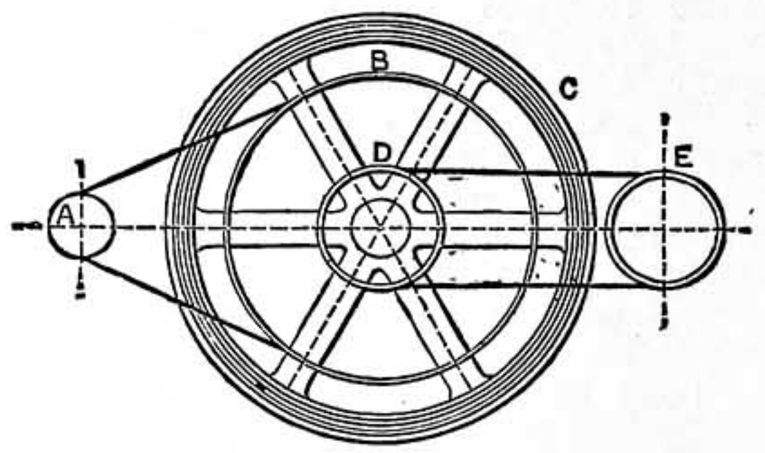


Fig. 2.—Fly Wheel connected with Motor and Lathe Head—A, Pulley Wheel on Motor, 3 in. in diameter; B, Driving Wheel of Fly Wheel, diameter 18 in.; C, Heavy Rim of Fly Wheel, diameter 28 in.; D, Smallest Rim of Fly Wheel, diameter 6 in.; E, Pulley Rim on Lathe, diameter 6 in.

"Now I entirely disagree with Mr. Pitman's idea of driving, as the above and what follows will show. If he knows anything of the 'theory of machinery' and the 'regulation and modification of force and motion,' he must be aware that he must have a fly wheel to equalise the inequalities which may occur during the running of the machine, lathe, or whatever he may be driving. Bearing this in mind, I proceeded to drive a fly wheel in the manner shown on the left of Fig. 2. The difference in gearing—3 in. at motor and 18 in. at wheel—at once showed signs of improvement, as the motor increased speed, and in a few moments ran the fly wheel at about 200 revolutions per minute. I next ran another gut to the lathe head (as shown to the right of Fig. 2), but the extra friction proved fatal to the speed, and caused the fly wheel to run at 50 revolutions per minute. This shows that the intervention which Mr. Pitman speaks of, but which he does not recommend, is absolutely uecessary. I have thoroughly tested the motor at other combinations of speeds, but find that which is illustrated the nearest to perfection. The quarter-man motor can drill a $\frac{1}{16}$ in. hole in brass, but very little pressure must be used, or it will stop.

"After exhaustive experiments with the New 'Demon' Water Motor, I find that it will run well if unopposed to any varying resistance, but should the slightest irregularity in the resistance at the point driven continue, the motor will gradually stop and the impetus given by the fly wheel will be exhausted. Further, the time taken to regain speed is so long as to cause it to be entirely unfit for anything that it is recommended for in Mr. Pitman's circular. I have carefully examined the working parts, both inside and out, and find them well made, and capable of running for a long time without readjustment."

From this statement, the only inference to be drawn is that, although as far as workmanship and materials are concerned there is no reason whatever for taking exception to the machine, yet when it is set to work and subjected to a practical test, the power generated is so small that, beyond running any small machine with which it may be connected, it is not capable of overcoming the resistance to the power that must naturally be expected, and will, as a matter of course, declare itself as soon as it is sought to carry out the kind of work, be it what it may, that is usually effected by the agency of the machine in question.

14.—ADAMS & CO.'S "PHOTOGRAPHIC ANNUAL."

The "Photographic Annual for 1891," issued by Messrs. Adams & Co., 81, Aldersgate Street, E.C., is in reality the price list of these well-known wholesale and export dealers in photographic materials and appliances of every kind, for, of the 304 pages of which it consists, one-third, roundly speaking, is literary matter and two-thirds price list. The price of the annual is 1s. 9d. post free, and the annual itself is well worth the money asked for it on account of the value and excellence of the papers that are to be found in it and the portraits which it contains, these being photographs of Mr. W. H. Harrison, editor of the *Photographic News*, printed on Schölzig's ready sensitised paper; Mr. J. Trail Taylor, editor of the *British Journal of Photography*, an Alpha print by the Britannia Works Company, Ilford, from a negative by H. Van Der Weyde; and Mr. Henry Sturmey, editor of *Photography*, printed on Fry's bromide paper, from a negative also by H. Van Der Weyde. Among the contributions are papers by Captain Abney, Mr. W. Jerome Harrison, Professor W. K. Burton, Mr. Chapman Jones, Mr. H. Snowden Warde, and other gentlemen well known in photographic circles.

15.—MESSRS. COX & CO.'S PRICE LISTS.

Messrs. Cox & Co., Electricians and Electrical Engineers, have recently opened new premises at 11, Fetter Lane, Fleet Street, London, E.C., opposite the *Record* Office, for the sale of all scientific materials. The illustrated catalogue issued by these manufacturing electricians should be specially useful to amateurs. One useful feature in the catalogue is that it is split up into different parts, distinguished as lists and sheets, each bearing a different letter with the exception of their "Temporary Price List of Manufactures," which deals chiefly with electric bells, batteries, light fittings, and sounder telegraphs. Thus, List E forms an illustrated appendix to their electric list; Sheet M, the price list of thermometers, barometers, drawing instruments, and meteorological and other apparatus; and Sheet O deals with optical apparatus, race, field, and opera glasses. A visit to Messrs. Cox & Co.'s establishment cannot fail to be instructive and useful in a variety of ways.

16.—MESSRS. RICHARD GARRETT & SONS' ILLUSTRATED CATALOGUE.

Farmers on a large scale, who are readers of WORK, may be glad to have their attention directed to the illustrated catalogue of steam engines, threshing and barn-work machinery, issued by Messrs. Richard Garrett & Sons, Leiston Works. As far as may be judged from the price list, and the engravings with which it is illustrated, the machinery supplied is certainly important in character, and seems to be of the best possible design and make. The most noticeable is their threshing and corn-dressing machine, Class O. F., fitted with the "Garrett-Ellis" patent drum beaters. Corn and manure drills, horse hoes, and other field implements are manufactured by the Company, whose works are of long standing, having been established in 1778.

I have received from Messrs. Henry Zilles and Co., 24 and 26, Wilson Street, Finsbury, the April part of *The Amateur*, containing some well-conceived figures for Pyrography or Poker Work. The figures, three in number, are equally well calculated for other decorative purposes and processes.

THE EDITOR.

SHOP:

A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

II.—Questions Answered by Editor and Staff.

American Lever Watch.—Horol.—Grip the staff in a pair of pincers in one hand, and take hold of the balance with the other, and turn it round till the slot or notch in the staff is exactly behind the pin that works the lever; and see that when the pin is moving the lever, the ends of the fork are free in the notch of the staff when going in and out; and when the staff is round, that the pin is out of the fork. See that there is a little shake or freedom. Try both sides, and make the shake equal both sides. Regulate the depth of escape wheel on the pallets, till the escape teeth, when fallen on the pallet, only just catch on the safe corner of pallets. The best way to test the hair-spring for length is by trying it for time. If you have not broken any off, it should be long enough; but supposing any should be broken off and you find the clock gains, unpin the spring and lay it on an oilstone, take a cork, and gently grind it down a little for width. Then re-pin it, and try again.—A. B. C.

Nickel Solution.—Curious.—The fault is not in the battery alone, although that is small, and I am surprised at the good results obtained from it. Your nickel solution has lost its free ammonia and become acid, hence the articles come out black. Get some blue litmus paper from a chemist and test the solution. If it turns the paper red, add some sulphate of ammonia, or liquor ammonia if you prefer it, to the solution until it ceases to redden the paper. If this does not cure it, add some more double salt of nickel (2 oz. to the gallon) to enrich the solution, stir up well, then pass the whole through a calico filter to remove the loose dirt. After this, test as before for free acid, and get it neutral before you attempt any more plating.—G. E. B.

Bending Cased Tube.—J. B. (*No Address*).—I am not quite clear as to whether you want to bend your $\frac{3}{4}$ in. cased tube to fit a curved bay window or an angular one. If the former, take a block of hard wood—say 3 in. square by 6 in. long—and bore a hole about 2 in. from one end. Let it be of such a size as to allow the pipe to slip easily through; fix the block of wood in a vice; place the tube in the hole, and gradually bend it, passing it through the hole as you do so; do not bend it too much the first time, and be careful to keep the tube always in the same plane—that is, after bending in one place. Do not lower or raise the tube when you make the next bend, or it will be "all of a twist," and very difficult to get right again. The way I usually fit up cased rods for a sharp angle bay is to mitre the ends, and to bend a piece of solid rod and fit it to the tube tightly and drive them on tightly: this makes the best job of it, as it is not practicable to bend cased rods or tubes sharply without damaging the brass casing. I might mention that the edges of the holes in the block of wood may with advantage be smoothed off a little.—R. A.

Driving Lathe.—Lathe.—If you cannot drive by the foot, there are many other ways you might adopt. A weight would do; but then, who would wind it up for you? also, it must be *very* heavy. Say you want 3,000 ft. lbs. per minute to drive your lathe, then you would require 1,000 lbs. falling one yard for every minute you work, or a weight of 60,000 lbs. falling one yard for every hour you work! I believe the Britannia Company, Colchester, make spring motors. You might have a little steam engine, like the hair-dressers do sometimes, or a gas engine, or a hot-air engine; or inquire what the water company would charge you per 1,000 gallons if you had a water motor; if not more than 6d. per 1,000, you could probably run a lathe by water for about 6d. per hour if the head is 60 ft.—F. A. M.

Mounting Cushman Chuck.—New Reader. I think from your question you must be trying to get your chuck true upon its face-plate by means of the screws; that will never do. Take it off, and observe the back of your Cushman; there you will notice a shallow recess, about $\frac{1}{16}$ in. deep, surrounding the central hole. You must turn away the outer part of the front of the flange, till you have produced a low cylindrical excrescence, not quite $\frac{1}{16}$ in. high, on to which your chuck will fit *without shake;* then fix your screws in any position, and the body of your chuck should run true. If you have already done this, and yet you find it does not hold work true, I would fit a small emery-wheel in a drilling spindle, and use that to grind the jaws of the chuck true; clamping a ring while truing the inside, and a bit of turned iron while truing the steps of jaws. You must not, however, expect absolute truth.—F. A. M.

Carriage Varnishing.—Barouche.—Carriage painting requires a seven years' apprenticeship. Without being so brief in reply as is the question, unfortunately, a concise account of the process shall be given, so that the tyro shall not go wrong and waste his time and money, and quite spoil his job at the attempt. An important omission in the question is not having said what sort of a carriage the learner desires to operate upon; another omission is not stating how much the carriage is worn that needs renovating, so that I am obliged to assume it to be a particular carriage, and that it needs to be varnished only, not retouched with paint and relief colours in part worn bare. Yet, I must not assume that, for no carriage that needs varnishing is perfect in its paint or colour beneath the varnish; again, if the colours had been mentioned, it would have enabled me to tell how to mix the repairing colours to match. These preliminary remarks should be noted by those who ask questions in Work, as, if the questions are fully stated, it makes the replies briefer and satisfactory. Why I ask what sort of a carriage it is, is because every description of carriage is constructed to take apart, and be put together for the special object of painting and varnishing a part properly. This is an important technical art in coachmaking, various carriages being taken to pieces in different manners. And this is what you must know, or your job will be a sorry botch. As the writer has assumed the *nom de plume* of "Barouche," perhaps it is a barouche he wishes to varnish; if so, it is one of the most difficult of open carriages to work upon. These carriages are built mostly on perch carriages, with Cee and under springs, costing new, from 180 to 220 guineas. I will assume the carriage to be a Stanhope phæton, as that general type of carriage will serve best to explain how many others are taken apart. Proceed thus: When thoroughly washed, put a trestle under the bottom of body, just behind the bolting-on of the back-bed or "horn-bar" of top-carriage; this trestle must be about 3 in. higher than the bottom of body, so as to raise the body up, the springs will come open that much; do the same behind with a trestle under the bottom of body, just in front of the back crossbar, 3 in. higher than the normal height of bottom of boot. The fore carriage is termed top and bottom carriages, joined by a perch-bolt at the wheel-plate, where one turns on the other. They are parted by knocking back a bent linch-pin or key, which goes through a slit on the point of the perch-bolt; you will need a steel drift-pin to effect this, as the key must be broken off close to the slit, mostly to get it out. Then the nut must be unscrewed right off; this needs a strong wrench, with jaws nearly 2 in. open, as this is mostly rusted and set fast, and you have to sit on the ground to work at it; take care it does not slip off the nut against your head, for you must pull towards your face, and it may cut an ugly gash that will delay the job a little while. I have seen it happen, even with experienced men. I may say that I admit writing feelingly on the subject, so I adopt a double-hammer tapping plan—that is, hold a 4 lb. hammer at an angle of the nut, and with a 6 oz. hammer tap the diagonal angle; this mostly starts the nut an eighth turn; then you may use the wrench to finish taking it off. Now, by lifting up the fore part of the vehicle body, the perch-bolt comes out of the bottom bed only (it is almost a fixture in the top bed); pull away the under-carriage with front wheels, and let the body down again in its place on the trestle. The top carriage has now to be removed; this is done by unscrewing nuts from four bolts through the ends of the bed and horn-bar. You must have someone to help you here, not so much to get the beds down from the bolts, as to keep them from dropping from the bolts suddenly, and perhaps breaking the dub ends of beds in concussion with the ground; the foot sometimes saves the wood striking the ground: so much the worse for the foot. The hind part of carriage, *i.e.*, the back-bar, springs, hind axle, and wheels, are easily removed—four bolts go through the body bottom sides and bar; take off the nuts, and tap up the bolts quite out of their holes, then wheel back that part away from the body. You will find a lot of dry mud on the bottom of body, that the washing-off could not reach; get this quite clean. You may say, that part is out of sight; but varnishing is for a double purpose: preservation from decay as well as nice appearance; and, though the bottom is never varnished, it is japanned to preserve it, and made smooth for easy removal of mud in washing. Now remove the dash-iron by taking off the four nuts, and the side wings, and top-rail of body, mostly fixed with nuts. I must not pause long over little difficulties, as of a nut turning round yet not coming off; should this occur, hold the end of a bar of iron at one edge of the nut, and with a light hammer and sharp cold chisel cut the nut in halves. Should the bolt turn in the wood instead of the nut unscrewing, drive a piece of saw-blade under the bolt-head; the saw-blade to be cut out with a long notch the size of the square of the bolt. Get someone to hold against the pull of the wrench; if there is any difficulty, always cut the nut in halves, it saves time. Brush the lining thoroughly, and cover up with brown paper, American cloth, etc., tacked down to the rail at the edge of the seaming; lace the tacks only just to enter enough to hold. The hind seat is usually fixed with four or five screws, and they are mostly rusted in; consequently have a good taper blunt-edged screwdriver, tap it well into the notch of the screw, and jerk at the same time as you turn with all your might. I have heard coachmakers say you must not stand to a nicety about rupturing blood-vessels in trying to get out screws; sometimes the set-fast screws need to have their heads chipped away a bit at a time; then the seat lifts up clear of the screw, to be unscrewed by a hand-vice. When all these separate parts are away from the body, you will see that these detachments were necessary for varnishing, and moreover, useful to point out the state of preservation of the woodwork of body and carriage, and the reliability of the bolts, springs, axles, and ironwork generally. The wheels must be taken off the axles by unscrewing caps and nuts; these are put away in a marked box. The tyres may be worn, and need renewing or contracting to brace up the loose joints of felloes and spokes; if so, do not attempt these difficult jobs for a tyro, but write to a wheeler to send for the wheels; it will not be expensive, and is sure to be well done. I can name plenty of good men in town or country if needed; they will put everything right, even to painting correct colours ready for varnishing. The taking apart just described is called "unhanging" in the trade, from the old-time plan of unhanging a body swung on braces. Two men would do it in from three to four hours, or a coachmaker would show you how. Now, your varnishing must only be attempted when the old surface of varnish is prepared to receive the new. Every part must be flatted off with pumice-stone powder and water, and a piece of strong woollen cloth for rubbing. Begin at the upper parts, finish cleaning off, and work downwards, cleaning as you go with clean sponge; a very clean wash-leather is most essential. If the boot sides are sun-cracked in the old varnish, you must turn the body on the side, on old cushions, and pumice-stone down with lump pumice-stone, till you have worn down the cracked varnish to the body colour; it will then appear a dull slate colour. This, if black, is first japanned with japan, which is a semi-opaque black varnish. Should any small parts have been rubbed through to the lead-colour priming coats, these must be touched with black first, or, better still, give it all a coat of dead black, laid on quite thin, then flat-off lightly with pumice-stone powder, and when dry, japan it, using a good flat pointed brush and a small tool to get into the corners. Now for a wrinkle: you do not want to show the brush-marks on the varnished surface, as if combed after painting; this is avoided by holding the brush very slanting, about 35 degrees of angle to the face of the work; if held at 50 degrees the points of the bristles rake the japan or varnish, instead of *sleeking* it at the finish off of the stroke. The touching-up of relief-lines requires care, with sable or camel-hair pencils and colour to match. The rims of wheels, edges of springs, and shafts, are the most worn parts, and may need body colour as well as "picking out." Allow a day or two for colours to dry before varnishing. Do not attempt to varnish in a dusty or damp place; it must be a clean, dry place, even if warm; it will be better for the lustre of the varnish. The wheels are swung on a projecting spindle, so that you can get at the back and front faces of the wheel—beginning at the nave, and working down the spokes to the rim, which is done last, at the tyre edge, which, being dirty mostly, however clean it may appear, ensures the brush being kept clean till the last stroke. If you decide to give any part two coats of varnish, flat-off first to an egg-shell dulness. A clever painter will catch the drying of the first coat on the "tack," and with a delicate handling of brush give a second coat in a few hours after the first, instead of waiting two or three days and then flatting-off the first coat. When varnished, avoid walking about near it, as it raises dust, which makes the varnish specky. Avoid the job being near a manure heap, which will make the lustre of the varnish iridescent or rainbow-hued, ending in dulness. After the whole has stood for a few days and it feels fairly hard, wash off every part with clean cold water, with sponge and leather; you cannot wipe off too dry, the oxygen in the water is absorbed by the varnish, and makes it almost as hard as glass. This is the secret of the lustrous enamels now being sold: they contain a supply of oxygen. Now a question: Are you sure your carriage needs varnishing? You may say it looks so dull; that is no proof of want of varnish. The following fact, which I can vouch for, will explain:—Mr. Murchison, the celebrated geological explorer, sent his travelling carriage to his coachmaker to be varnished, but said it must be ready in three days to go abroad; he came punctually with post horses for his barouche, and was astonished to find his carriage more lustrous than he had ever seen it before, even when new, and asked the coach-maker what sort of varnish he had put on. "None at all," was the answer; "I have taken off some." "Explain!" said the great explorer. "Your carriage was overloaded with varnish, and it has been flatted-off with pumice and water, and polished with rotten-stone and oil, and the lustre worked up with the hand and old worn silk handkerchiefs. It will stand the hottest sun or keenest frost better than new varnish." This will impart to you how you may improve the panels of your carriage, for they receive little wear compared to wheels, springs, and carriage, should the panels appear dull and you defer varnishing. To put a carriage together that has been unhung, first, put up the top carriage, then the under carriage, well greasing the perch-bolt and wheel-plate. To do this, the wheels, front and back, may be put on the axles temporarily to uphold the springs; remove the trestles, and clean and oil the axles one at a time, bolt on dasher wings and body-rail, then touch up the nuts with colour or japan afterwards. As to where to get materials,

the largest and best selected stock of carriage materials, rough and finished, is to be got of Messrs. Whittingham and Wilkins, 136, Long Acre, W.C. They will advise in the selection of prepared colours, varnishes (always copal), and brushes and pencils. —J. C. K.

Duplicating on Photo Plate. — AMATEUR. — If small grooved strips of wood are attached to the upper and lower part of the framing of the camera, immediately in front of the position the sensitive plate will occupy, and a piece of blackened zinc sufficiently wide to cover *half* the plate, and sliding in this groove from side to side as occasion may require, all that is necessary will be provided for taking *two* pictures on *one* plate. The screen being fitted, one exposure is made; close the shutter of the slide, and alter the position of the zinc screen, and make the other exposure. This is a very simple, workable, and effective contrivance.—E. D.

Wiping Joints.—A NEW READER.—It *is* usual to "tin" the parts to be joined, but the tinning is done by wiping the molten metal round the joint, which, of course, is previously cleaned and greased with tallow or a mixture of resin and tallow. You say you melt down the "ordinary" solder in bars. What do you call ordinary solder? Perhaps you have been using tinman's solder. If so, this is too fine—that is, it will "run" too freely, and could not be wiped up into the right shape. Your solder for wiping joints should be a mixture of lead, two parts; tin, one part—pounds, ounces, or anything you please in the above proportions.—R. A.

Oval Boiler Lid.—J. S. (*Poplar*).—To make this, first ascertain the inside circumference of the boiler. A rough estimate can be formed by taking twice the length and once the width of the article. Having found this, divide it into three or more parts, according to the length of the stuff you have to cut the rim out of. Thus, if the boiler requires a rim 39 or 40 in. round, three lengths off a "single" plate which is 14 in. long would do very well. Cut them 1⅜ or 1½ in. in depth. The pieces should be not quite straight, but slightly curved; tack them together so as to preserve the evenness of the curve, and fold over ⅛ on the inner side of the curve (this is done on the hatchet stake); flatten it down, and turn round; shape to the boiler and tack it so that it fits well, but not too tightly. Next throw off an edge—this also on the hatchet, unless you possess a "jenny." This will put the rim out of shape, so it must be put right again before proceeding with the next process, which is cutting out the top. Place the shaped rim on a plate of tin of sufficient size and mark round the outside of the edge of the rim; cut ⅜ of an inch larger all round—this will allow for hollowing; for this a wooden block will be required, and one or two block hammers, and this is the process that will give most trouble. Make a ring of blows about 3 in. from the edge all round, and then work towards the outside, smoothing out the puckers as you go along. Use light blows, then go over it again with slightly heavier blows, and you will find it working up. When hollowed up sufficiently, smooth it off. Place it on a flat place, and see if it touches all round; if not, press it into such shape that it will do so. Throw off a wide flange on a crease iron or bick iron, if no jenny is available; then turn up an edge, and slip rim in, and pane down the edge. The making and fixing of cover handle I think you will not need to have explained.—R. A.

Mosaic Flooring.—MOSAIC.—Form the foundation of hard dry material well rammed, and bring it up within 6 in. of the finished surface. Cover this with 3 in. thick of broken stones, well rammed down, and lay upon the stones 2 in. of cement concrete, formed of six parts of crushed bricks and one part of cement. This must be finished level, and allowed to set hard. Then lay out the centre portion of the floor between the borders by means of laths 3 in. by 1 in., planed straight, and laid to the exact size of the centre portion. The tesseræ can be had cemented together in slabs about 8 in. square; but when made in this way they are above 1 in. thick, and the surface of the cement concrete must be ¼ in. below the slabs to allow for cement jointing. They can also be had fixed on strong paper, the face being next the paper, and in this case are not so thick as when formed into slabs; but they are much more difficult to lay, on account of not being able to see the face of the work. Great care is also needed in jointing one to the other, and there is a danger of the outside pieces coming off the paper when they have to be fixed by hand. In whichever way you get them, they are laid in the same manner as encaustic tiles on a bed of cement, and beat down level with the laths by means of a hammer and a piece of flat board. If you refer to page 428, No. 79, Vol. II. of WORK, you will find a description and sketches of the method of tile laying, which may be of service to you. You will receive from the firm supplying the tesseræ a plan showing the various parts of the floor in colours, which, if they are formed into slabs, you will easily understand, and if they are fixed on paper, will be marked or numbered for your guidance. You must be very careful in handling them, if on paper, to see that none of the pieces drop out; should any do so, you will have to insert them after you have beaten them down. The paper will come off while you are beating them down. You will also, most likely, receive printed instructions for laying them when the plan is sent. As you have not laid any before, I should advise you to get someone to assist you in laying them who has had experience, as they are much more difficult to lay than ordinary tiles.—M.

Polishing Paste.—PASTE.—(1) *Sweet* or *olive* oil will be best for moistening the paste. (2) Emery is the active ingredient in most preparations for polishing metals, though putty-powder (calcined oxide of tin) is also a valuable material for that purpose. But PASTE asks how a *cheap* paste for polishing knives may be made. The following has been recommended as inexpensive, and at the same time efficacious, and not liable to wear away or blunt the knives:—Brickdust and scraped yellow soap are to be pounded and mixed together. The paste is moistened with water, and applied on flannel. The blades require to be washed with warm water after using the paste.—S. W.

Choice of Trade.—TERRA COTTA.—Without knowing what your capabilities are, it is difficult to advise you, but assuming that you have to work for a living, I should advise you to remain at your present occupation, and learn all the different branches of the trade. You should also make yourself acquainted with the various clays and brick-earths, methods of mixing, moulding, and burning, as these vary in different districts. As to wages, if you get to be expert in all branches you might get £2 per week or more, or you might get to be a foreman or manager in a large works, at a higher rate. If you have any talent for modelling, and follow it up, you can obtain better pay. Terra-cotta and encaustic tile work are also higher branches, if you can get into them. To become a draughtsman, you should go as an apprentice or articled pupil into a drawing office. After serving your time, you might get 25s. or 30s. per week to begin with, gradually advancing according to your abilities; but you will require influence or have to pay a premium to get into an office, and would probably receive no salary till out of your time. You can learn drawing while at your present employment by joining a science class, which would not cost more than 5s. per term. You should learn freehand, model, perspective, machine and building construction, plane and solid geometry, and mathematics. If you get to be expert at these, you might then get a situation as a draughtsman.—M.

Silvering Buttons.—E. W. (*Leith*).—There is no method I know of to "silver" brass buttons to stand exposure for an unlimited length of time to all weathers except the Sheffield method of plating, or the way in which harness is plated—that is, by covering them over entirely with sheet-silver. Even these would be bound to wear through with continual cleaning; and besides, silver could hardly be applied in the form of sheets to any finished buttons except plain ones. Are you not asking for an impossibility? Look at the silver in your pocket, and you will see how sixpences and other coins get worn down. Now, should not this bit of common experience have caused you to question the possibility of depositing silver in anything like the same thickness you here see worn off? Cannot you procure the buttons in German silver instead of brass? then you would always be able to restore the colour by brushing where the plating had worn off.—H. S. G.

Light Dog-Cart.—N. I. (*Falsgrave*).—The measurements of a dog-cart suitable for a pony thirteen hands are as follows:—The framework of the body to be of oak and panelled with baywood or birch. The length of body on top rail is 36 in., the length of the body at the bottom from the back to the front in a straight line is 57 in., the depth of the side is 20 in. The width of the body at the top is 36 in., at the bottom 34 in. The front dash and the splash wings can be of birch or white-wood or enamelled leather; the splash wings if of wood will be 36 in. long, 6 in. wide, and ¼ in. thick. The shafts are of lance-wood, and fit at the outside of the body. The length of the shaft from the tip to the draw-bar is 63½ in.; the rest of the shaft extends to the end of the body. The seats are 36 in. long by 13 in. wide, the front seat having a back-rest upholstered both sides. The springs are 46 in. from centre to centre of eyes, with five laps or plates in each spring, 1½ in. wide, and ¼ in. thick each lap. Either the Collinge or mail axles can be used. The wheels will be 4 ft high when finished. The nave 8 in. long by 6 in. wide. Spokes, width 1½ in. by 1¼ in. thickness. Felloes, thickness 1¾ in. The width of the tire 1⅜ in. by ⅓ in. thick. The lamps, as is now fashionable, should be placed at each side of the body near the wheel. The body should be painted black without any finishing or striping, with just simply a monogram in gold or colour in the centre panel at the back and the two sides, or a crest if entitled to one; the wheels, springs, and shafts to be painted vermilion picked out with a quarter-line of black. I do not understand your first query. Is it a lorry for a pony you mean? If you could send a rough sketch of what you want it would greatly oblige.—W. P.

Clock Parts, Etc.—H. R. P. (*Lambeth*).—Pack your clock, and take it to Grimshaw & Co., 35, Goswell Road, Clerkenwell, and tell them to make your face and fit hands; give them instructions as to shape, size, style, etc. They would also get a case made for you as you want; or for case you might try J. J. Stockall, 6 and 8, Clerkenwell Road: he may be able to get a case made for you. —A. B. C.

Sizes of Bassinette.—H. W. (*Manchester*).—Your query for sizes of wooden bassinette, coach style, to seat two children, is one to which I am unable to reply. I am frequently drawing bassinettes (on paper) for manufacturers, but as I do not draw them to scale, I never trouble to measure them. There is no reason why you should not discard stock dimensions, and use your own judgment as to those most suitable for your purpose.—J. S.

Polishing.—J. W. (*Birkenhead*).—Undoubtedly, polishing is better for such a piece of work as your small cabinet than varnishing. This has been repeatedly stated in "Shop." If you have already stuck down the frets on the panels, you will only make a mess of the job if you try to stain, varnish, or polish the sunk ground, either with glaze or anything else. It will be necessary to leave this part of the work in the white. If you wish to do so, you may oil it, but it is questionable whether you will improve the appearance by doing so. The plain portions can be polished after staining black or any other colour. Stain first, then size, and finally polish in the usual way, using black polish if the job has been stained black. Dull down, if required, with emery powder. Black polish can be made by adding a little gas black to ordinary polish. If you want your little cabinet well finished, it may interest you to know that Mr. F. Warrington, 47, 49, and 51, Heath Street, Myrtle Street, Liverpool, makes a speciality of finishing work for amateurs. He is a polisher of wide experience, and his charge for doing the cabinet will only be trifling.—D. D.

Upholstery.—T. G. (*Neston*).—The job you propose is a very ambitious one for a novice. You would require to know vastly more than the mere construction of the roll and its stitches before you could have the slightest chance of success. You could hardly have selected a more difficult job in ordinary upholstery. The small chairs you might possibly manage to do—after a fashion—but not the couch and easies.—D. D.

Chess Board and Scraps.—R. W. M. (*Kildare*). —To make a chess board, get a sound dry piece of mahogany. Clamp the ends so as to form a square of the desired size, and you may consider the base ready. Get some veneers of the colours you intend to form the squares of. Cut them into the requisite number of square pieces. Glue them down in proper order on a piece of paper. Outside them lay a piece of stringing, either plain or mosaic, and beyond them borders of a suitable width of mahogany. Lay on one side till dry, then go over the unpapered side of the veneers and the top of the base with a toothed plane. Glue and lay down the veneer. When the glue has set, clean off the paper, smooth down, work mouldings (if any) on the edges of the board, and finally finish off by French polishing. For the complete process of laying veneers, read the exhaustive series of articles on the subject in Vol. I. of WORK. I am afraid that you will have some difficulty in removing your scraps from the screen, as they have been varnished, without injuring them. A good deal, however, will depend on the material to which they have been stuck. If it is calico or any similar substance which will allow moisture to act on the backs of the pictures, the removal will be easier than if it is finished with a waterproofed facing. With a porous backing, all you have to do is to apply warm water till the glue is sufficiently soft to allow of the pictures being removed. In the other case, give it up as a bad job.—D. A.

Polishing.—G. W. (*Plumstead*).—To finish a wide surface with glaze, free from dull streaks and from ridges, the glaze should be used as a polish; see that the surface is free from oil, the rubber soft and free from lint. Apply the glaze as evenly as possible, going over the surface several times, until the rubber is nearly dry; then with the smallest quantity of oil and a little spirits go over the glaze, very lightly at first, varying the direction of the rubber to avoid ridges. A *dull*, even surface may be obtained by adding one-third to one-half of sandarach to the solution of benzoin, and using the rubber damp only—not saturated.—F. P.

Milling Machine. — DESPAIR. — The milling machine bears about the same relationship to the file that the circular saw mill bears to the hand saw. There are, of course, some kinds of work to which files must be applied and milling cutters cannot be used instead. Milling cutters may be worked at such a high rate of speed, and the feed of the work into cut can be so rapid, that any work a milling machine can tackle may be done on this machine quicker than on any other. As to the quality of the work, its evenness, straightness, and smoothness are the nearest approach to perfection of that of any machine tool, and if keen-edged cutters are employed, there is no way of improving this, short of grinding and polishing. Milling by circular cutters is not treated upon exclusively in any book, but a dozen pages are given on this subject in "The Metal Turner's Handy Book," price 2s., published by Lockwood & Son, and the information there given would enable you to form an idea of the capacity of this method of shaping metals. For the purposes you name, a valve milling machine would be the kind best suited, having two or four spindles and using end or butt cutters. There is no better machine than this to do such work; it is specially designed for milling the square and hexagon parts of brass cocks and similar fittings. The spindles are adjusted independently by hand wheels, so that the cutters can be brought together or separated to any distance within the limits of the machine. After adjusting the cutters and milling two opposite sides, the work is rotated through an angle of 90° for a square, 60° for a hexagon, or 45° for an octagon, and again traversed between the spindles, by which process two other opposite flats are milled true and to precisely the same gauge. This second process would complete a square, but a third traverse is

necessary for a hexagon, and a fourth for an octagon.—D. H.

Gilding on Glass.—YOUNG SIGN WRITER.—The process is too long to describe in this column; it requires one or two articles to treat upon it practically, and give full working details. Perhaps the Editor will soon see his way clear to give these chapters. I am not at all surprised that you should know nothing whatever on this subject, as there are many good writers who never attempt it, and look upon it as the work of a specialist, such as the glass embosser. It is not very difficult, however, and, had I the space, I could give such clear directions that any sign writer could execute the work with ease and credit. You ask about the size used for fixing the leaf to the glass: you are mistaken in surmising that this is the ordinary gold size, for it is not, and no decent work could be done with it. The size is made by the writer as follows:—Purchase some fine isinglass, or Nelson's No. 1 gelatine, and take as much of this as can be placed on a shilling without piling it too high; place this in a tea cup half full of boiling water, and stir well till thoroughly dissolved. Before the size has had time to cool, fill up the cup with pure spirits of wine, and incorporate well together. The size is then strained through a piece of fine linen, or, better still, silk handkerchief, and is then ready for use. The gold leaf used is the ordinary kind. The lettering is first set out on paper, being of course reversed: this is pasted on the outside of the glass. The glass is thoroughly cleaned inside and polished with talc. The letters are then formed with the size, using a good camel-hair pencil, and the gold leaf is lifted from the cushion with a "tip" and dabbed with cotton wool. When dry, the gold assumes a burnished appearance; and if now it is rubbed with a piece of cotton wool, the brilliancy will be increased. The gilding is now repeated, the same process being followed; and, when dry, the loose gold round the edges is removed with cotton wool.—H. L. B.

Air Gun Walking Stick.—G. E. B. and W. LONGDEN.—There is a lock to the gun in the fore half of the barrel, between the trigger and the middle screw joint. The air-chamber is in the rear half of the walking stick, of thin iron; the barrel, half screwed in front of it, though only bored for a ¼ in. bullet and charge, is necessarily of stout iron to continue the outward semblance of a walking stick. It is in this thickness of iron between the bore and the outside that a slotted recess is cut in which the trigger-spring works—out of sight, as it is cased in by a thin covering of iron flush with the rest of the stick; an outer skin, as it were, just at this part only. This spring acts upon a plunger just at the back of the charge chamber. When the trigger is pressed, this plunger—about ¼ in. diameter or less—strikes a piston in the centre of barrel air-chamber just past the joint of the two barrels. This lets out a jet of air, which passes the plunger and drives out the charge from fore barrel. The valves are packed with soft leather, and the piston is kept up to its place by a coil-spring till driven back by the plunger striking it in the centre. The lock in its recess is somewhat like the ordinary lock and spring of a gun, but small. The air does not get to the lock, as it is outside the chamber or charge bore. The outlet for the charges of air that escape is the same, but pressure is less forcible towards the last charge of five or six charges or air impulsions.—J. C. K.

Indiarubber Felloes.—J. H. (*Winchcombe*). Mr. Aves, Barbican, E.C., rubber felloe manufacturer, is the inventor, to whom apply.—J. C. K.

Enamel Cloth.—E. L. (*Woolwich*).—For enamel cloth used for infantry men's valises, try Whittingham & Wilkins, 135, Long Acre, W.C.—J. C. K.

Prize Bookcase.—W. H. B. (*Birmingham*).—If you will kindly let me know what you cannot understand, I shall be pleased to put you right.—E. D.

Sign Writing—Spacing Letters.—IMPROVER.—The whole of the information you require is to be found in the articles on "Sign Writing and Lettering," which appeared in Vol. I. of WORK, part in one chapter and partly in others. Get Part 4 or No. 17, and you will find pretty clear instructions therein for giving a symmetrical appearance to words. It must be remembered that all letters should not be the same distance apart; for instance, the space between such letters as K, O, P, Q, V, W, and Y, and the letters on either side of them should be less than for ordinary letters; and the same rule applies to "serif" letters; they must be kept closer together (see example, page 259, Vol. I., in above number of WORK). I have also given directions for spacing large letters on high walls in one of the chapters, but am unable to trace the exact chapter just now. Briefly, no fixed rule can be followed, as no two situations would be alike, and the letters must, of course, be formed as to size and spacing to suit the circumstances of the case. An experienced writer finds no trouble in doing this, but a novice will find it easier to first measure his space on the wall and then arrange his matter on a blank wall near the ground. When the size and spacing of his letters are satisfactory, he can take full measurements, jot them down in his pocket book, and then, by the aid of these and a measuring rod or straightedge, proceed to set out his work on the gable end of the house or any other high situation. All this is really not difficult, and you should watch a good sign writer at work. There is not much scope in your town, I know, for very high-class work—the narrow streets will not allow it—but you, no doubt are frequently in Birmingham, and here you can often see writers engaged, sky high, on gigantic letters. In London, "sky signs" are injuring this class of work.—H. L. B.

Volume of Work.—OLD NORWICH.—15 per cent. duty will be chargeable upon volumes which you may send to Canada.

Cost of Dynamo.—ELECTRIC.—You have neglected to give the voltage of the dynamo, hence I cannot give you a definite reply. A dynamo to give 10 ampères of current may have a voltage of 10, 20, 50, 100, 500, or more volts, and its cost rises with the voltage from £10 to £100, or more. The horse-power will also rise with the voltage from ⅛ h.p. for a dynamo to give a current of 10 ampères at 10 volts pressure, up to 7 h.p. for a machine giving 10 ampères at 500 volts pressure.—G. E. B.

Shocking Machine.—F. V. (*London*).—Have two sliding bars for handles. The left-hand handle should be fitted with a lever moving a switch to throw the battery in or out of action. A notch is made in the upper part of the bar, and in this notch fits the short end of a lever to prevent the bar from being pulled out until a penny, falling into a small scoop at the longer end of the lever, tilts it up free from the notch. The other sliding bar is to be connected to the sliding regulator of the coil, and must also have a transverse piece of brass fitted to it to sweep the penny into the till as the bar is drawn out. Attach a cord or piece of catgut to the sliding regulator and pass this cord over a pulley on the spindle of the dial hand. Cords attached to weights should draw the handles back when they are released. By pulling out the left-hand handle the battery is thrown into action. By drawing out the right-hand handle the strength of the shock is regulated, and this is shown on the dial. When the handles are released, they are drawn into the box, and the locking lever falls into its place again and locks the switch.—G. E. B.

Staining.—CLYDESIDE.—You will find in No. 95, Vol. II., a paper on "Imitation of Woods by Plain Staining," etc. A direct reference is made to maple staining, and I can only add that yellow pine, if simply varnished with copal, two or three coats, or twice sized and once varnished, if expense is an object, will be as near the tone of maple as you will get it without painting and graining. Now go carefully through the paper, and then ask yourself—Is it fair to want more from us? If you desire to ornament the cot, put some of the same ingenuity and perseverance at work in reference to papers on "Imitation Inlaying" that you have already displayed in making the cot itself.—DECORATOR.

Pitch Pine.—SAW MILL.—You question the correctness of sentence commencing "Real pitch pine," to "from the Baltic," in page 694, Vol. II. I have to answer that (1) the articles being treated from a grainer's point of view, "Real pitch pine" was a term used to express, in a general sense, those figured varieties of pine wood belonging to the natural order *Coniferæ*, commonly known to the grainer as "pitch pine." The illustration accompanying the paper was used for explaining technical processes, and shows a simple grain of the wood alluded to. (2) I am aware that much pine wood comes from the States, as instance the celebrated pitch pine of Savannah; but it does not come from the States *only*, as your note implies, for in 1876, I find, nearly 300,000 tons of white pine and 40,000 tons of red pine were exported from the *Dominion of Canada*. (3) Beyond this, the genus *Pinus* is not only indigenous to the countries of the Baltic, but even to Northern Britain; and, finally, I beg to state that the writer has a very intimate connection with a seaport, very remote from Liverpool, to which pitch pine is imported from the Baltic, and where it is largely used as stated in the article.—DECORATOR.

Paint Queries.—W.S. (*Inverness-shire*).—For full particulars of plain painting and the nature and uses of all painters' pigments and fluids, see series of papers thereon in WORK, Vol. I. Get it at once before the price goes up to a guinea, which is its true value to most people! For external—*i.e.*, preservative—painting little or no turpentine is necessary. The province of the latter oil is to thin the linseed or get "dead" surfaces of work. Quantity of driers depends partly on the pigment used, some having a natural drying power, and others quite the opposite. For most pigments and lead paints, one of driers to ten of pigment in winter, and one to sixteen in summer, would suffice. This, again, is qualified by (1) the strength and quality of the driers, and (2) the purity of the oil. Boiled linseed oil is usually substituted for the ordinary raw oil for external painting, and particularly for ironwork. Being boiled upon *oxides of lead*, etc., it takes up their drying nature, and is therefrom often termed "drying oil." The process makes it thicker and darker, and hence it is only suitable for dark-coloured paints. The drying power makes it also more susceptible to blistering on most kinds of woodwork, and many painters don't use it at all nowadays. Red lead, being *oxide of lead*, is a natural drier, and this, added to its natural weight, causes it to settle and harden when lying by. Remedy—Mix only as much as you want for use each day, and so keep it well stirred. You will gather that the oxide of lead communicates its powers of oxidisation to the oil it is mixed in, and thus not only dries it when in ordinary use, but continues such action upon it when standing, and makes the paint "fat," in professional parlance.—F. P.

Emigration and Employment.—ABSTAINER.—It seems from your letter that you are an able-bodied man, ready and willing to turn your hand to anything, and that you have saved a little money. Further, to judge from the locality in which you live at present, you are accustomed to agricultural work, and can do a little in chair-making. The best thing you can do is to write to John Pulker, Esq., Emigrants' Information Office, 31, Broadway, London, S.W. State your age, say you wish to emigrate to South Africa, and ask him to send you such papers as may tell you what to do in order to obtain assistance in getting there. He will send you the necessary forms of application, etc. You might certainly be able to work your passage out, but I am not acquainted with any shippers, so with regard to this I can give you no particular information as to the best means of getting a ship. As, however, you are not a sailor, you would be unaccustomed to the work on board ship, and, I daresay, would find difficulty in getting on any ship's books. You would find it better in every way to go out as an emigrant assisted by Government.

How to Make a Telephone.—H. P. (*Oxford*).—An article on the above subject appeared in No. 28 of WORK.

Machine Rollers.—BREMNER.—I fear the advice you ask for in your letter will not be of much service, as I can scarcely understand what your difficulty is. The "hopping" of rollers over the type suggests to me that the runners of your machine are too low, or perhaps worn rough; then the "lifts" would not support the rollers at all, and their full weight would press on the "forme." Try nailing on strips of thick wrapper or cardboard with tinned tacks, the length of the runners from the slab to the "pitch." If one thickness is not sufficient, add others till the rollers "flick" over the "forme" merely. After washing your rollers after the job is off with petroleum, or turpentine, or terebine, do you sponge them over just before using them again with a sponge and clean cold water? This restores the "bite." The sponge should be merely well damped, not wet. If you find the "suction" is not renewed by this means, your rollers want re-covering wtth new composition, which should not be used too "green"—*i.e.*, too new. Be careful to see that your roller "lifts" are exactly of the diameter of the roller-mould, or they will be sure to jump on the "forme." I strongly recommend the "Durable" roller composition as being more economical and lasting longer, and also having more bite or suction on the ink-slab and formes. If you have a "blank" page, or a title, or other light page, or part of a page in the forme, nail on the runner nearest to it, exactly opposite it, an extra strip, or even two, to lift the ends of the rollers higher still over that part. A little experimenting in this direction will give you a new sense of power over your ink supply, and enable you to avoid a light page being over-inked, and a heavy page thereby being robbed of its full inking. Write again if I have misunderstood your queries, and send to the Durable Printers' Roller Co., Limited, 57, Shoe Lane, for price list and information.—J. W. H.

Bookshelf Leather.—C. A. F. (*Holland Park*).—This is obtainable of Messrs. E. J. Willson & Son, 21, St. Bride Street, London, E.C.

Cast Brass Cooking Utensils.—If anyone can supply you with the articles mentioned in your query, it would be Messrs. Benham & Froude, Chandos Street, London, W.C.—R. A.

Spark from Induction Coil.—R. E. L. (*Chingford*).—From a coil having a core 9 in. in length by ¾ in. in diameter, wound with 4 lbs. of No. 35 silk-covered copper wire as a secondary coil, and having a condenser of 150 sheets, you should get at least a 2 in. spark, if the coil has been properly constructed. I see, however, that you have started with an initial fault in employing No. 16 double cotton-covered wire as the primary. The insulation should be silk-covered, soaked in melted paraffin. Shellac varnish is not the best insulator. You fail to get more than a ¾ in. spark because the coil is badly insulated, and therefore you increase the trouble by employing more cells, since the higher tension current then pierces the defective insulation, and the extra current is absorbed in the coil instead of traversing the secondary, and appearing at the points in the form of sparks. If you go on increasing the cells, you will entirely ruin the insulation of the wires, and also the condenser, by internal sparking. The efficiency of the condenser is shown by decreased spark at the break, and increased spark at the terminal points.—G. E. B.

Induction Coil.—R. McC. (*Glasgow*).—A 7 in. core should not be 1 in. in diameter. Half of this is quite enough for such a small coil. The paper tube should be only 1/16 instead of ⅛ in. in thickness, and should fit close to the core. The primary should be No. 18 or 20 silk-covered, not No. 16 double cotton-covered wire. You cannot get this large size close enough to the core to properly magnetise the iron. If the coil is for sparks, you will find better results from No. 36 than from No. 34 as a secondary. Soak all the wire in melted paraffin wax before winding it on the coil. See that the hammer of the break is not too heavy or the spring too strong to allow free working of the break.—G. E. B.

Electric Bell.—A. G. F. (*High Wycombe*).—If you get No. 18 of WORK—and you can get the number direct from the office for 1½d.—you will find therein a full illustrated description of the "parts of an electric bell which cause the bell to ring," and "proper" instructions showing the way to make them. In a series of articles on "Burglar Alarums," running through the first volume of WORK, the making and fixing of electric bells are described.

The articles appeared in Nos. 12, 18, 20, 27, 31, and 33 of WORK.—G. E. B.

Whitening Silver-Soldered Joints.—C. C. (*Birmingham*).—I suppose you have hard-soldered the joints, and in doing this have brought the copper of the silver alloy to the surface. This causes the smoky brown stain of which you complain. You have failed in boiling out the stain in dilute vitriol, because you are using the pickle too strong, and do not warm your work enough before putting it in the pickle. Use one part oil of vitriol to forty parts of water, and heat the work to a dull red after soldering. If the joint is soft-soldered, or the silver is poor, you must electro-plate the article to whiten it after soldering.—G. E. B.

Fan Mounting.—A. H. W. (*London, W.*).—Mdme. Ida, 7, Prince's Street, Regent Street, London, W. (entrance in Castle Street), intends taking up fan mounting. She has only lately commenced business on her own account, so the fan mounting may not be started yet. A. H. W. could inquire there. Also of Mrs. Haitland, Amberly Art Studio, Crouch Hill, N.—C.

Small Tin Boxes.—PASTE.—You can obtain small tin boxes such as you inquire for, suitable for paste, blacking, etc., from either of the following:—A. Truelove, 14, Carver Street, Sheffield; or G. Stradling, 21, Florida Street, Bethnal Green, London, E.C. They are very cheap, and the makers will quote you a price according to the quantity that you require.—R. A.

Claws or Feet for Fountain.—J. R. P. (*Uttoxeter*).—You will get these through any local furnishing ironmonger; if not, try and make some yourself—first modelling them in clay: then take a cast in plaster of Paris, and from this make castings of melted compo. pipe. As they are for ornament only, they can afterwards be soft-soldered to the legs of the stand, as shown in the design.—C. M. W.

Electro-Motive Force of Batteries.—R. E. L. (*Chingford*).—The E.M.F. of zinc and carbon immersed in the ordinary bichromate of potash solution employed in charging battery cells is about 2 volts at the instant of closing the circuit. All sizes of plates have the same E.M.F. The internal resistance of a single cell having plates 7 in. by 4 in., and placed $\frac{1}{2}$ in. apart, would be about ·03 ohm. Therefore, the current at the terminals of a battery of three such cells would be at the moment of closing the circuit $\frac{3 \times 2 = 6}{3 \times \cdot 03 = \cdot 09} = 66{\cdot}6$ ampères. Through a resistance of 1 ohm, the current would be 5·5 ampères only at the moment of closing the circuit. The E.M.F. falls, the internal resistance rises, and the current falls as soon as current begins to pass. As the E.M.F. of the three elements under favourable conditions in a solution of 1 sulphuric acid to 12 of water is only ·57 volt, we must employ plates of sufficient size, and put them near enough together to pull down the internal resistance to ·5 ohm, if we wish to get a current of 1 ampère from the battery.—G. E. B.

Drain Work.—W. B. & Co. (*Hammersmith*).—You will probably find a suitable book in the following list:—"Handbook on House Sanitation," by E. F. Bailey Denton, price 4s.; "Sanitary Engineering," by J. Bailey Denton, price 25s.; "Sanitary Engineering," by Baldwin Latham, 24s., published by B. T. Batsford, 52, High Holborn; "The Sanitary Drainage of Houses and Towns," G. E. Waring, price 10s. 6d.; "House Sanitation," by G. W. Stanger, price 1s.; "House Drainage and Sanitary Plumbing," by W. Paul Gerhard, price 2s.; "How to Drain a House," by G. E. Waring, price 6s., published by Spon, 125, Strand. As you live in London, you could see them, and decide which is most suitable for your requirements before purchasing.—M.

Electric Incandescent Lamps.—J. M. (*Halifax*).—Electric incandescent lamps of 10 candle-power, or of any candle-power, have no chimney of any kind, nor any wick, flat, round, or otherwise, as in paraffin lamps. They are simply little globes of glass, made quite air-tight, with a thread or wire of carbon sealed in each globe. When the electric current goes through this wire it gets white hot, like iron at a welding heat, and this gives out the light. The wire does not burn away. You must have a battery or a machine, as well as a lamp. Read my articles on "Model Electric Lights" in Vol. II. of WORK.—G. E. B.

Accumulator.—E. G. (*Erdington*).—I do not know a 6 c.p. lamp. The Edison-Swan lamps are made of 5 and 8 c.p., but nothing between. The 8-volt 5 c.p. lamps take about 3 ampères of current, and the 16-volt 8 c.p. lamps take about 2·7 ampères of current to light them. They would thus need an accumulator having a capacity of from fifteen to eighteen ampère hours to light the lamps up from five to six hours. You would find a four-celled V type E.P.S. accumulator enough for the 5 c.p. lamp, and an eight-celled V type E.P.S. accumulator suitable to the 8 c.p. lamp. There are three plates in each cell, and four or eight cells respectively in each box. The external dimensions of the boxes are given at 6 and 7 in the table on page 791, Vol. II. of WORK, but the number of plates differ. Instructions are also given there for making and charging accumulators.—G. E. B.

Measuring Glass.—J. J. F. (*Shaftesbury*).—The following apparatus are required to estimate the hardness of water by Dr. Clark's method:—Mohr's burette with pinchcock, 25 c.c., in 250 divisions, 2s. 6d.; stand for ditto, 1s. 9d.; 70 c.c. pipette, to measure out the water, 11d.; 1,000 c.c. flask, with mark on neck, 1s. 6d.; and a stoppered bottle to hold 7 or 8 ozs., 4d. For alcohol, get $\frac{1}{2}$ pint methylated spirits (3d.), and dilute it by putting 350 c.c. (measured out by taking 70 c.c. five times) into the 1,000 c.c. flask, filling the flask up to the mark with distilled water, and shaking well. If your chemist has not these things, he will get them for you, and you might ask him to show you how to use them. There is no need to convert the quantities given into English measures, as the apparatus are sold as above. 1,000 c.c. flasks often have "1 litre" ground on them; 1 litre is 1,000 c.c. Get "Wanklyn's Water Analysis," published by Trübner & Co., Ludgate Hill, for 5s.: it is written so plainly that you will understand it.—F. B. C.

Ship Model.—R. J. (*Rawtenstall*).—You had better get someone in the neighbourhood to furnish you with the design you require of a ship stationed, as you say, at Leith.

Fire Smoking.—H.S. (*Milnsbridge*).—If you refer back to the answer to F. W. B., on page 46, No. 55, Vol. II., you will there see some of the difficulties in dealing with smoky chimneys pointed out. In that instance there was some doubt as to why the smoking occurred, but in your case it is pretty plain. For example, in the first place, it leaves off smoking when you open the sash, which clearly shows that the fire is not sufficiently supplied with fresh air: the remedy for this you will find explained in the answer spoken of above. If this was the only defect, the matter would be simple enough; but when you say it also smokes when the fire in this particular room is *not* alight, and other fires (or fire) are, the matter at once becomes complicated. This may arise from a variety of causes, a few of which are:—Firstly, if the "withs" or partitions between the flues have been improperly built, and holes or cracks left in them, the smoke from the flue in use may penetrate the one complained of, and from that enter the room in which the fire is not burning. This in particular might be noticed if the doors communicating between the two rooms are left open so that the fire could draw air down the unused flue, and with it smoke. This very often occurs, although there are passages and staircase between them, providing there is no fresh air inlet along the route. Secondly, if the two fireplaces communicate in one flue. Thirdly, if the top of the chimney pot of the smoky chimney is below the level (or even level) of those next or near it, the smoke will sometimes be drawn or driven down, especially if there is not a good up-draught, and by your showing there is certainly not. Now for the remedy. If from my suggestions you fancy the first or second is the cause, it is a very difficult and expensive matter, especially the latter, and a simple way to obviate it is to see that the register of your stove fits close, and close it when you do not require a fire. If you have no register, fit a piece of zinc or other material in the opening. The great objection to this plan is that it robs you of the ventilation you get from your chimney, but that can be got over in a variety of ways. If you think the third suggestion is the cause, put a lengthening piece to the chimney pot, or, better still, a cowl. I think, from what you say, that by putting a cowl on the top of your flue, and supplying it with fresh air at the bottom, you will get over the difficulty. I can give you no idea as to the cost; but if you show this to any good tradesman, he will at once tell you about what it would be. The cost of these little jobs vary so much with circumstances.—E. D.

Harmonium Reeds.—A. P. (*Renfrew*).—Harmonium and organ reeds are similar in construction; they consist of a plate of metal (zinc) with a slot in the middle, over which a tongue of brass or steel is riveted in such a manner that it can vibrate easily with a pressure of air applied to it. In harmoniums the wind is *forced* through the reeds, and in American organs it is *sucked* through. The difference in pitch is obtained by varying length and thickness. No one would make either organ or harmonium reeds themselves when they can be bought at such very low prices as at present. It would be a needless waste of time and trouble, and very questionable if the results would be equal to those bought ready made. The voicing and tuning of course are different, and might well be attempted and accomplished by an amateur.—R. A.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—L. P. B. (*Kew Gardens*); A. F. E. (*London, S.E.*); R. W. A. (*Gray's Inn, W.C.*); H. J. H. (*Hackney, E.*); ONE IN TROUBLE; A NEW READER; W. H. R. (*London, E.*); F. W. S. (*Heathfield*); FAITHFUL READER; R. C. (*Tipton*); AMATEUR; A. B. (*Manchester*); A. J. H. (*Manchester*); C. B.; T. M. (*Southampton*); L. L. H. (*Falmouth*); R. A. (*Sheerness*); IMPORTANT; W. R. (*Manchester*); P. F. (*India*); NAP; J. W. (*Blackpool*); G. H. (*Bacup*); M. W. C. (*Newnham*); J. C. (*Cheadle*); C. P. (*Manchester*); J. D. (*London, E.C.*); SOMERSET; SLEEPY; UT SPES NON FRACTA; F. C. (*Londonderry*); RICHARD III.; F. B. H. (*Wolverhampton*); M. H. (*Dorset*); P. L. H.; J. H. M. (*Beau Parc*); F. H. (*Birmingham*); PIP; E. J. S. (*Maidstone*); BRAMAH; J. R. B. (*Sheffield*); BRASS WORK; J. J. A. (*Wandsworth*); BARFF; W. A. (*Maidenhead*); J. S.; POLYITE JOINER; W. H. R. (*St. John's Wood*); PUZZLED: STAND STILL; WEEKLY READER; SIDEBOARDS; IRONMONGER; WHEELBARROW; HARD-UP; VERGE; R. B. (*Edinburgh*); F. W. W. (*Sheffield*); G. P. (*Elgin, N.B.*); J. R. T. (*Perth*); B. N. (*North Seaton*); A. H. (*Bolton*); LEARNER; W. B. E. (*Walsall*); W. W. C. (*Kelso*); F. K. (*Oldham*); SUBSCRIBER (*South Africa*); GILDER; T. T. (*York*); BYKER; M. M. (*Liverpool*); P. P. & Co. (*Manchester*); F. P.; H. J. (*Bradford*); T. W (*Sleekburn*); T. P. S.; H. B. S. (*Liverpool*); J. G. I. (*Aberdare*); W. D. (*London, W.*); F. E. H. (*Lancaster*); J. J. B. (*Twickenham*); HOLLY-READER; CANOE; A. W. T. (*Willesden Junction*); SILK BANNER; W. H. (*Prince Edward Island*); X. Y. Z.; J. H. F.; T. A. G. (*Stratford*); R. B. (*Durham*); F. S. S. (*Leicester*); J. B. (*Wallington*); S. A. W. (*Liscard*); H. H. L. (*Cheshire*); J. B. (*Lancashire*); A. H. (*Oldham*); S. W. R. (*Brixton, S.W.*).

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